Is the Central Station Justified in Maintaining a Wiring Department?—
Managers Present Arguments on Both Sides of Problem Citing Many Experiences

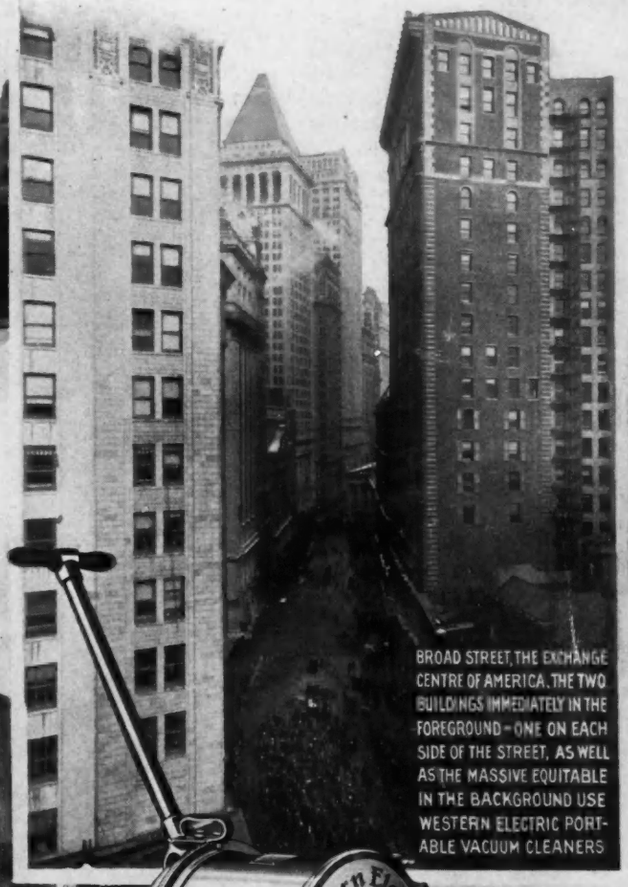
Electrical World

New York, March 24, 1917 McGraw-Hill Publishing Co., Inc. Vol. 69, No. 12 10c a copy

Engineering Library
MAR 24 1917
UNIV. OF MICH. LIBRARY

IN NEW YORK —
Prominent Buildings - Dominating Well Known Neighborhoods, You Will Often Find In Use
Western Electric
PORTABLE VACUUM CLEANERS

UNITED STATES RUBBER BLDG.
BROADWAY AT 58TH STREET


BROAD STREET, THE EXCHANGE CENTRE OF AMERICA. THE TWO BUILDINGS IMMEDIATELY IN THE FOREGROUND - ONE ON EACH SIDE OF THE STREET, AS WELL AS THE MASSIVE EQUITABLE IN THE BACKGROUND USE WESTERN ELECTRIC PORTABLE VACUUM CLEANERS

MASONIC HALL, 23RD STREET AND SIXTH AVENUE

CANDLER BLDG. 42ND ST. WEST OF SEVENTH AVENUE

STRAND THEATRE BROADWAY AT 47TH STREET

Western Electric Company
INCORPORATED
HOUSES IN PRINCIPAL CITIES

THERE has been no other factor in creating the prestige which now surrounds the Weston name than the outstanding superiority of

Weston

Indicating Instruments

So high have Weston products established the name in the field of Electrical Measurement that it is in itself an endorsement of each Instrument that bears it. It is our fixed purpose to maintain, and if possible to increase, the value of this endorsement.

POWER-FACTOR METER

The Weston A. C. Round Pattern Switchboard Instruments are unrivalled with respect to mechanical and electrical design and workmanship, and hence with respect to performance.

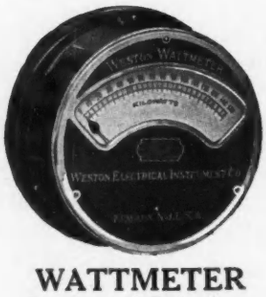
Competent engineers know that this Weston group is the only one which meets perfectly the practical requirements of operating service, and they likewise know that the initial cost is little, if any, more than the cost of inferior instruments, and that because of their continuous accuracy and serviceability they are much more economical to adopt than instruments of any other make.

The Instruments, consisting of Ammeters, Voltmeters, Wattmeters (Single and Polyphase), Power Factor Meters, Frequency Meters and Synchroscopes, are thoroughly described in our Catalog 16.

Complete groups of Weston Switchboard Instrument Transformers are described in our Bulletin 1501.

VOLTMETER

AMMETER



WATTMETER
Single and Polyphase

Weston Electrical Instrument Co.

13 Weston Ave., Newark, N. J.

New York	Boston	Chicago	Detroit	Montreal
Buffalo	Philadelphia	Richmond	Toronto	London
Cleveland	St. Louis	Denver	Winnipeg	Paris
Cincinnati	Pittsburgh	San Francisco	Vancouver	Florence

Petrograd, Johannesburg, South Africa

Electrical World

The consolidation of Electrical World and Engineer and American Electrician.
Published by the McGraw-Hill Publishing Company, Inc.

Vol. 69 NEW YORK, SATURDAY, MARCH 24, 1917 No. 12

Western Water Powers

THE Supreme Court has just rendered a decision affecting the use of public lands for water-power purposes which settles, in favor of the government, the contest which has been waged for several years past between the public land states and the departments in Washington as to whether or not the congressional act of 1866, giving rights-of-way over government land for the use of water for beneficial purposes, has been repealed. A number of the public land states intervened in the test case which has just been decided, setting up the material interest of the public land states in the question at issue and claiming that under the congressional act of 1866 the holders of water rights under state law were entitled to a permanent easement over any government land necessary for the beneficial use of the state's waters.

Contrary to the popular impression, the decision of the Supreme Court does not at all touch the question of the control or use of the waters of any state, but merely decides that the so-called act of 1866 was, by clear implication, repealed by the congressional act of 1896, and that a right-of-way over government lands for water powers cannot be obtained except under the act of 1896 and subsequent acts covering such matters.

Now that it is settled that the act of 1866 is no longer in force the power developments in the public land states in all cases where the use of government land is necessary can only be made under the more recent acts of Congress, which do not give permanent tenures and compel the companies using rights-of-way over government lands to take out right-of-way permits or easements and to pay such rental charges therefor as the federal government may reasonably demand. In other words, until there is further legislation the effect of this decision is to deny fee title to rights-of-way over government land and to restrict the use of such rights-of-way to revocable leases or easements issued by the Department of Interior or Agriculture.

During the past session the administration strongly favored the passing of new laws so as to give safe tenures to rights-of-way over government land for power companies operating under the state laws. The present federal laws on this subject are unworkable and the growth of the public land states is greatly retarded by their application, and it is the hope that these laws will soon be changed so as to make it practicable for Western power companies to obtain safe tenures to rights-of-way over government lands.

The far Western states need and must have hydroelectric power. Coal as a fuel is virtually unknown to them, and oil is now so costly that steam raised by this means cannot compete with water power. The public wants and should have cheap electricity, and cheap electricity in all Pacific Coast States means hydroelectric energy.

Are We Doing Our Duty?

IT is our duty as business men that Mr. Hurley meant when he discussed the question before the Associated Manufacturers of Electrical Supplies. As business men we admit an obligation toward business. Not merely to draw salary or profits, but to realize that there is, as he said, a statesmanship of business. Most people express contempt for their public representatives, yet they give power to men whom they afterward regard as misrepresentatives. Or if they do not by voluntary vote give the power they do not by vote, interest and effort withhold the power which they say ought not to be given. In general, the cheerful attitude which Mr. Hurley would have business take is that there are good men on both sides of the fence. In co-operation they will get results. The representatives are holding office. They are the "ins." They are in a position to do what the "outs" cannot do. But if those who are outside will explain their point of view to the chosen leaders there cannot be afterward a claim by the leaders that they did not know what they were doing. An eleventh-hour telegram does not meet the need. Much of the mischievous legislation of recent years has gone upon the statute books precisely because some one did not know what he was doing. A positive, not a passive, attitude is a right as well as a duty.

What Co-operation Does

IF the manufacturer of supplies had been told four years ago that he would have in 1917 a strong, effective, growing co-operative organization serving his part of the industry alone he would not have believed it. The record of the Associated Manufacturers of Electrical Supplies is unique. The conception of it which joined the founders together was able and far-sighted, the execution and evolution of time have brought it to great usefulness. The general officers, Messrs. Sheppard, Debevoise and Dustin, have consistently developed a broad, liberal, exact plan for welding the interests in legal co-operation. Behind them have been the members, meeting on common ground to discuss common problems. Differences have been swept aside in the larger aim. Small contentious points gave way before the strong purpose which underlies the organization. There is a spirit of mutual helpfulness, of willingness to yield something for the attainment of a great end.

Coal Economy

WHEN a commodity stays at a fixed price, our consumption of it at a normal rate is a routine matter; when the price goes up to a staggering height, we count the cost, we look for economies, we think ahead to see what it means in future operation. Copper, generating apparatus and coal are possibilities of revolutionary character. Copper is indestructible, apparatus has long life, but coal consumed is gone forever. We optimistically assert that coal is foolishly and unwarrantedly high, but the prudent inner voice tells us that here is a mighty issue which is worthy of our best and clearest thinking. The man who does not agree with us overlooked the very interesting figures which Mr. Gilchrist gave in an interview published in the issue of March 10, 1917.

Seven thousand tons a day is the coal consumption of the great Commonwealth system of Chicago. It doubles every four years; glance onward to 1929 and think a moment of the estimated daily requirement of 56,000 tons for this one public servant. To-day the real conservationist is not popular; his day will be in a later year. The question that the public will ask then is whether exhaustible coal resources are being conserved. From the central station industry the answer will be a loud, proud "yes." First, because the facts of high price and shortage will mean redoubled effort to attain economy in coal-burning apparatus. Second, for the reason that the central station, by virtue of its production on a large scale and low cost of distribution of power, is the most economical agency. It stands for, embodies and practices conservation.

Electrically Equipped Furniture

AMONG the many interesting pieces of work undertaken under the auspices of the N. E. L. A. is a campaign directed toward the encouragement of electrically equipped furniture. At present this is rarely seen outside the high-class hotels in which it is not infrequent to find dressing tables, bureaus, beds and other pieces of furniture fitted with electric lamps and other connections ready to be plugged in to any convenient baseboard outlet. It is a matter of common experience that in furnishing a room it is quite usually found that the architect, being obsessed with some notion of symmetry, or entirely negligent of the proper use to which the room is to be put, has caused his fourth acting subassistant draftsman to locate outlets where they are of the minimum possible service.

By mounting the furniture itself with electrical equipment located in exactly the proper place and with connections to be plugged in to a baseboard or lighting circuit these particular difficulties can be avoided. The cost of electrical equipment for furniture when it once becomes reasonably common is so slight as perhaps even to result in ultimate economy by the abolition of unnecessary and useless fixtures elsewhere. And the result upon the whole should have favorable effect on the cost of wiring. Incidentally, we might add that inasmuch as the standardization of electrically equipped furniture will probably be a rather slow job, much more than is now common ought to be done in the way of special furniture fixtures. If designed in light and efficient form furniture fixtures ought to find a very wide field of usefulness in giving greater convenience to the utilization of electric light in ordinary living rooms.

Electrical Equipment of Coal Mines

A VERY instructive paper by Mr. Weber in the current issue deals with the practical results of substituting complete electric equipment for the old shaft power plant in coal mining operations. The data given are doubly interesting inasmuch as they give the results of an actual change from the older to the newer drive. The initial state of things was the usual distribution of compressed air for mining tools and equipment and a mechanical haulage plant for the coal cars. Besides the central power plant thus constituted steam engines were in use elsewhere for crushing, hoisting, loading and ventilation. In the particular case described the actual expense for material and labor, apart from all overhead charges, rose to more than $7,500 a month. The first stage of rejuvenation of this old-fashioned plant did not include the electrification of the haulage plant, which subsequently proved to be a rather important matter. Leaving this out there were still a very material saving in operating electrically, both in the reduction of labor and in the cost of the coal consumed, although this latter was estimated on a basis of only about $1 a ton. A detailed study of an electric haulage plant, which has not yet been installed, showed a saving due to it alone of more than $1,000 a month. Incidentally, an opportunity was given in this plant of comparing the cost of a small electrically operated mine with the older equipment. The result was an advantage in coal consumption of more than 400 per cent and in power plant labor expense of 40 per cent. The total expense for energy in the electrically operated mine was less than one-third that on the older system.

The comparison brought out, however, some of the weaker points in the electrical equipment which designers and inventors should bear in mind. The conditions in this particular case forbade the use of chain cutters, so that electrically-driven coal punching machines and rock drills had to be used in the mine. It turned out on investigation that with the electric drive the machine operator could not do quite as much work as with the air-driven machines, in spite of the fact that the total expense of operation was lower with the electric system. The electric pick is a relatively light machine with a fixed stroke which very considerably lessened the speed of feeding, there being no automatic adjustment of the stroke length. On the other hand, the electric rock drill proved to be less convenient to set up and move around than the air drill, and Mr. Weber makes a plea for the oscillating type of drill. The efficiency of the latter need not be cause for worry in view of the performance of the average air drill. On the whole, the

discussion shows very plainly the large general economies to be reached by the use of electric drive and incidentally points the moral that when there is to be a change in the motive power system, it should be made at once and completely rather than piecemeal and with hesitation. It should be added that in this instance the electrical energy was purchased at a low price, 1 cent per kilowatt-hour a figure which, however, can be matched in a case of many large consumers situated on transmission systems.

Testing Automobile Engines Electrically

THE use of the generator for engine testing is in itself an old device, yet our readers will find in the account of the testing room of the Willys-Overland Company much that is of novelty in the technical applications of this familiar process. The point of the matter is that an automobile engine has to be subjected to several testing processes before it is finally installed. To begin with, the engine must, so to speak, be licked into running shape mechanically in order to secure the best running conditions. No matter how carefully the parts of the machine and the engine are assembled, friction at the first turn-over is a somewhat serious matter, and the machine must be settled to its bearings before it is given its formal load test. Then it is ready to operate at its various running speeds with a full connected load. As a result of this double requirement the testing room here described is fitted for operation of the engines by the electric machines as motors, and for the reverse process, the first requiring energy from the lines, the second turning it back into them. It is worth noting that the direct current machines proved most advantageous for the work on account of the speed variation required.

In the testing process the first step is to mount the engine on the testing block with the help of a motor-operated hoist, and then to work the electric machine as a motor with all the armature resistance out, to drive that engine at 500 r.p.m. merely as a mechanical load. This ordinarily overloads the driving motor by some 300 per cent for a very brief period, say from one to three minutes, at the end of which time the engine is down to business and the load drops to normal. Then follows a half-hour run at the same speed with a further decrease of load to about 20 per cent of its full value. At this point the speed is still further increased to 700 or 800 r.p.m., at which it is kept for an hour to an hour and a half, until the engine is fairly down to its proper friction load. Following this the operation is reversed. The engine is set in operation of its proper function, driving the electric machine as a generator and pumping energy back into the line. Next it is throttled, for from half an hour to an hour, to about half load on the generator, then the speed is sent up to full load for an hour. By this duplicate process it is made certain that the engine is fully down to its normal performance before it is assembled in the car, and the load of some of the engines is utilized to supply mechanical power for breaking the others to their bearings.

The operation is facilitated by several highly ingenious switching appliances. In the first place the resistance in the armature circuit, which is cut into at the initial running speed, is utilized in the shunt-field circuit for increasing the speed in the latter part of the power run. By using duplicate circuit breakers, one set high, to protect against short-circuits, and the other set at a moderate overload, it is necessary for the testing operator to hold in the latter circuit breaker during the period of severe overload when the static friction of the engine is being worked off and thus stay vigorously on his job. Associated with these breakers, too, is an automatic cut off for the engine magneto, so that if the electric load goes off the engine is automatically stopped. The great practical advantage of this ingenious testing system is not only to save power, owing to the double use of machines, but particularly in the rapidity and facility in which the tests can be executed. The working is much steadier than with a brake equipment. The output of the testing room can be doubled and the quietness of the operation resulting from the abolition of belts and brakes gives the testers a much better opportunity to watch for any lack of precision in the working of the engine. From the great simplicity of the system it has turned out that the testing costs also are greatly reduced. A similar testing equipment has been installed in another factory and with like favorable results. For low cost of installation and operation coupled with great working efficiency the electrical testing machine seems thoroughly to have made good, and its advantages ought to appeal to all other automobile companies which have similar testing problems to face.

The Coming Issues

NEXT week an article will appear, dealing with the electrical features of a New England cotton mill, in which reasons will be given for selecting certain equipment and arrangements instead of others. The second section of Prof. Alfred Still's articles on design of high-tension transformer insulation will also be presented in that number. In the first issue of April, which is the public policy number, there will be published articles showing the trend of court and commission decisions on utility questions. The regular monthly compilation of central station earnings and energy output will also appear in that issue. In addition the April 7 number will contain the statistics gathered every year by the ELECTRICAL WORLD, showing the output, peak load and time of peak on the largest generating systems in America for the year 1916. For the sake of comparison similar data where available for 1915 will be given for each company so as to show the extent of the growth during the year. Every generating system having an output of 100,000,000 kw. hrs. and over will be included. Subjects of interest to station and operating engineers will be discussed in the second issue of April. The ELECTRICAL WORLD for April 21 will take up methods of making direct-current network calculations and effects of adding new conductors.

Should Central Stations Wire Houses?

A General Discussion of This Question Through the Medium of Letters from a Number of Central Stations, of Which Some Do and Others Do Not Maintain a Wiring Department

By Earl E. Whitehorne

IS there any justification for a central station wiring department? Some say "yes"; some say "no." Who is right according to the best experience?

The fact that so many central station companies still continue to wire houses in competition with local contractors shows that this is still a mooted question. Many are doing wiring because they evidently consider it profitable or necessary; while many others have abandoned the practice as fundamentally wrong.

Should the central station operate a wiring department? Does it do more harm than good, through alienating the good will of the contractor? It is an important issue and the diverse opinion and experience cited in this article is more than interesting. It is worth a little careful study.—The Editors.

SOME time ago the writer sent letters to a large number of central stations, widely scattered over the states, and differing no less in size of city served than in the general conditions encountered. He put the problem, "Is is good for the central station to maintain a wiring department?" and received a very large number of replies in which opinion differed all the way from yes to no, and men gave evidence to prove that they were right. It is interesting to see how attitude has grown out of local experience and how the local experience has been induced by conditions, that repeat themselves so generally throughout the industry. These letters seem to offer much good counsel and the writer will briefly quote from those that carry such suggestions—withholding the names to avoid causing any feeling locally.

"It Brings More Business"

The advocates of central station wiring are very definite in their reasons. "We believe we are justified in having a wiring department," says an Indiana company. "Before we established this department there were very few new houses wired, and as for old houses they were at a minimum which was entirely due to the fact that the contractors, having no competition, exacted exorbitant prices for the work. Since establishing this department every new home has been wired complete and the number of old houses wired has been very satisfactory."

A Wisconsin company writes: "In our judgment, we should go after this business energetically, and maintain an organization to that end for the same reason that in the operation of our gas department we solicit house piping work in competition with the plumbers. Possibly some little feeling is stirred up in connection with central stations and gas departments doing this class of work, but still the utility is held responsible for the results at all events, and for that reason, if for no other, should handle this business."

Another Western man believes that central station wiring is essential until the territory is well saturated, but not beyond that point. He says: "The central station should maintain house-wiring departments and do the work as reasonably as possible until the connected load is developed and a very large majority of the old houses on the lines are wired up. I have in mind one town where we were forced to do house wiring. The contractors had maintained a very high price for such work and, repeated efforts on my part to have them reduce these prices being unavailing, it forced us into the house-wiring game. Up to that time about the only thing that was being connected to our lines were new houses. We established a house-wiring department, wiring houses at a small cost, our per cent of profit being from 15 to 20. In two years we had wired and connected to our lines more than 600 houses in a town of approximately 1000 people. On the other hand, I could name several other towns under my jurisdiction where we do not wire houses and the matter is handled entirely by the contractors, where the development is very, very slow. Therefore I am very much in favor of the central station maintaining a house-wiring department and doing the work as reasonably as possible up to the point where the lines are fairly well saturated. After that point is reached I believe the wiring game should be dropped by the central stations and given to the contractors."

The Time to Start?

In almost contradiction to this view, however, is the argument in a letter from a general manager who operates a chain of properties in a state a little farther west. He says: "As long as conditions in this town, or any other, as regards the saturation point of electric light users, are as at present, I believe a company can get along quite as well in the matter of increasing its number of customers without being in the wiring business as it could if it did maintain a wiring department. Whenever such a point is reached, however, where new customers are difficult to get the entire matter hinges on the prospect's being able to get his wiring done at a low price. Then there is nothing for a company to do but to embark in the business, since an electric lighting company is the only person or corporation that can afford to do wiring without charging a percentage to cover all overhead in connection with the wiring business, and to make only a small per cent on the capital tied up in stock of supplies."

In other words, this man would wait until his lines are loaded, while the previous manager contended that at this point central station wiring becomes no longer necessary. Each bases his opinion on the experience he has personally met—which is evidence enough that it is well to know the other fellow's views.

An entirely different reason follows the testimony of another medium-sized Western city. "In our situation," writes this commercial agent, "we consider it both profitable and necessary to continue this department. There are a large number of small, one-story houses here which are occupied mostly by the foreign element, and we have put a flat rate into effect which enables our salesmen to quote prices for wiring these houses without first getting an estimate. The average price of wiring a house of this character amounts to $16 (excluding fixtures) and it has been our experience that the local contractor will not try to get this business for the reason that there is not sufficient profit to pay him to spend any time in promoting the sale.

"Our increase in meters last year amounted to about 700, and of this increase we estimate that fully 150 meters were secured from the small houses tenanted mostly by the foreign element. If we were to discon-

tinue house wiring I estimate we would lose at least 100 new consumers per year. Therefore, although we do compete with the local contractors, it is a fair competition and there exists the best of feeling between the contractors and the company."

PROTECT THE STANDARD OF WORK

This same situation affects a good many cities and seems to have caused the institution of a large number of central station wiring departments, while in some cases the active competition of the gas company is given as the reason. But by far the most numerous among these letters is the statement that the central station competition protects the standard of the work done in that town. It is well expressed by one manager this way:

"We believe there is justification for the central station wiring department because it insures wiring installations at a cost not excessive. We bid on all wiring jobs, but are not disappointed when outside men secure the contract. In this way we can give our personal attention to a great many cases where the installation would not be properly made except for the supervising jurisdiction exercised by bidding on each wiring job. There is no hard feeling between the wiring contractors and ourselves. They know we will not underbid them to secure the job and we do no wiring except at a price that justified us in doing the work."

Experience has proved again and again that the electrical men can be brought together as a family, that such contact produces harmony and common purpose and that such common purpose welds a working unit that soon puts an end to bickering and wasted opportunity. There is no doubt but that this problem of who should do the wiring can be solved in the average city as it has elsewhere if the central station manager is willing to do his part. The answer then is, "Let the central station cultivate the right 'conditions' so that it may keep out of the wiring field except for proper temporary purposes."

But in a Kansas city, apparently they have found a way to bring about the same desired result on another basis, and the sales manager writes: "It is my opinion that this business should all be turned over to the contractors, providing they are members of a contractor's association, and are recognized as able to do the proper kind of work. We have tried both systems in the various companies with which I have been connected in the past four years, and there is only one successful plan, and that is to co-operate with the contractors, providing they are desirous of working with the central station. We find that we cannot depend on them to sell or push the sale of appliances, but we derive considerable benefit from turning over all wiring business to them, and carrying the accounts."

This letter points the value of co-operation with the contractors, and a further argument on the point is well put by a manager in Arkansas. He says: "My experience teaches me that it is absurd for a central station to do wiring, for the central station can co-operate with contractors, and thus insure that only a reasonable profit be earned and first-class work done. And there are many advantages in having good, live contractors in the field, for more business will be secured and a live contractor is practically as good as, and sometimes better than, a salesman employed by the central station. If you encourage him he will certainly get the business."

"OFFENDS THE PUBLIC"

The bad influence on public opinion of a lack of harmony in the local electrical family is dwelt upon by many companies in discussing this question. For instance, this from North Carolina: "I know it is a fact," says this general manager, "that some enterprising central stations do house wiring in competition with local contractors and justify their action by claiming that it means a greater increase in business to the central station. I question this very much, as I believe that it brings about a bad feeling between the local contractor and the central station. It also produces a feeling with the public that if the central station does the wiring it should, for ever and a day, maintain the work which it has put in. I believe that it is very important for a central station to live in very close harmony with the public as well as with all branches of business, and it does not do for a central station to produce the impression locally that it is trying to monopolize too much."

And this same point is covered in further detail by an Illinois company that operates in a large number of communities. This man writes: "It has been my experience that in such towns where we have maintained an interior wiring department that the company not only has alienated the contractor's affections, but created a false field of competition and public prejudice. I find that in towns where central stations maintain the wiring department that the company itself has secured more contracts than in towns where no such department exists, but that in such towns the number of contracts secured by both the outside companies and the central station is less than where all of the wiring is done by the outside contractors. We have at the present time actual figures embracing several years that prove this condition in several of our towns."

HIGH PRICES AND COLLECTION TROUBLES

"Among other things," says another man in Illinois, "if the light company is asked to submit bids on a job, it will naturally figure on the best material possible and of sufficient capacity to take care of the expected increase in heating appliances, whereas the local contractor will figure to make as much as he can and still get by. The result is that the light company's figures are largely in excess of those submitted by the local man and the local man gets the job and the light company adds another item to the charge that it tries to hold up the customer."

And there are many more who express the same opinion. Also it is claimed that such central station wiring departments are usually an actual source of expense because of the wasted labor, the cost of overhead and supervision and through the losses in collection.

As a Nevada manager puts it: "Our main reason for discontinuing this department was on account of the difficulty in collections. Consumers would pay their electric bills, allowing the wiring account to ride, and while this might be considered to be our own fault, we have found it very difficult to make collections just the same, and of course it was not possible to discontinue service on account of non-payment of wiring accounts. Such disputes in regard to wiring bills lead to ill feeling on the part of the consumer." And another man in North Dakota adds: "It is undoubtedly a fact that where the central station does the wiring the consumer is more apt to allow his account to become delinquent than if the wiring is handled by a local contractor."

The opponents of central station wiring are therefore quite as decided and as specific as its advocates, and yet there is a point dwelt upon in the majority of the letters received, the dominating factor of local conditions —caused unquestionably to some considerable degree by the very policy of the central station itself. As a

Georgia man says: "This is a matter which should be governed entirely by local conditions. If satisfactory conditions cannot be obtained from the contractors, then it is the duty of the central station, in justice to itself and its customers, to go into the wiring business."

Or, looking at it from the other angle, as this Middle Western man does: "If contractors will solicit wiring and co-operate with the companies in campaigns to secure new customers, it would be much better if the companies stayed out of the wiring business. I find, however, in many cases where the companies do not do wiring that contractors become independent, do not solicit business, and increase their charges to such an extent that prospective customers will not wire their houses. In such cases it becomes absolutely necessary that the companies do wiring."

"Only Two Good Reasons"

One more letter from another Kansas manager seems to sum it up rather well. He says:

"I believe that there are two causes which may force a central station to do wiring. First: If the central station finds it impossible to make a fair increase without taking wiring and fixture contracts, then it is certainly up to it to do this work, regardless of the effect on the contractor. Second: If it becomes necessary, in order to take on more consumers, to install wiring on a monthly instalment basis the central station may be forced to finance and operate the entire campaign. Often the contractors in smaller cities and towns have no or very little competition. They have all they can attend to without spending any time rustling business, and this naturally causes them to pick the plums, and charge a very high figure for their installations. The increase of the number of electrical consumers is thus greatly minimized, especially residential consumers. In a case of this kind it is up to the central station to induce another contractor to come in or get into the business itself. On the other hand, if there are plenty of contractors in a town, and they are in lively competition for business, and are still holding the standard of wiring up to where it should be, I can see no reason why the central station should get into the business. Apart from the one idea of gaining consumers, the central station has no business in the wiring game. I seriously doubt that one ever yet cleared any money in it. So I would say to every central station: Keep out of the wiring and fixture business, if possible, but if it is absolutely necessary to take wiring and fixture contracts, in order to secure new business, I should think the wiring in turn should be sublet to the contractors on a competitive basis, if it can be satisfactorily arranged."

This Matter of "Conditions"

Surely it would seem from reading these letters that central station men are very strongly divided in opinion on a very basic question of policy. And yet there doesn't seem to be the slightest doubt in anybody's mind which way is right. Theoretically and in practice it is better for the utility to leave the wiring business to the wiring contractor, provided that conditions in the town are right. The utility knows that if the contractors are good men who do good work and maintain the proper standard of construction, it is far better to have the valuable aid and influence of these independent workers actively co-operating in the development of the business. For everybody has agreed that a few good contractors are a powerful selling force and bring a lot of new consumers to the circuits and find a market for appliances that would otherwise long remain unsold. And the men who advocate a wiring department admit that it was bad conditions in their towns that forced them into it. Therefore, it all boils down to this: that the first and most important thing of all is to make "conditions" right and keep them so. And who can say that if the central stations now engaged in wiring had put the same amount of thought and time and money that they have invested in their wiring department, into the problem of perfecting these "conditions," it would not have brought about the organization of a corps of contractors of far more productive value to the companies?

It must be realized, of course, that there are small towns where no good contractor could make a living and the lighting company must wire up the houses. Also, there are situations where a monster wiring campaign develops more business than all the contractors can possibly take care of, and the central station is compelled to lend a hand, and organize a wiring force of its own to help keep up with the selling force. But these are cases not considered in this article. The point the writer wishes to make is this: Too many central station managers seem to have this idea that they are powerless to combat these "conditions" that they talk about.

What Experience Proves

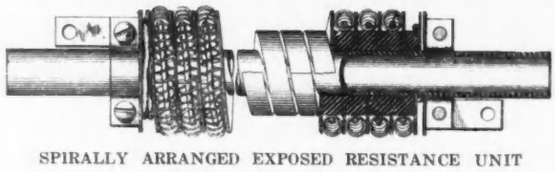
Experience in other cities has proved again and again that the electrical men can be brought together as a family, that such contact produces harmony and common purpose and that such common purpose welds a working unit that soon puts an end to bickering and wasted opportunity. There is no doubt but that this problem of who should do the wiring can be solved in the average city in this same way if the central station manager is willing to do his part. It may not come at once. It may take several years, depending on how long it takes him to make new friends. But it can be done.

Cities are very much the same. And contractors are much the same. They must be prosperous to be contented and productive, and the central station and the manager of the utility must realize that he is under no small obligation to make possible this prosperity and to protect it. It pays him better than a wiring department, so it seems that the answer to the problem is this: Let the central station cultivate the right "conditions" so that it may keep out of the wiring field—except for proper temporary purposes.

OPEN RESISTANCE UNIT

Compact and Flexible Device with Spiral Base That Can Be Formed of Any Number of Sections

Spirally arranged resistance wire exposed freely to the air is embodied in a device (patent No. 1,209,568) patented by George H. Dorgeloh and Eugene Pons of Schenectady, N. Y. The resistance unit is compact, flexible and may be conveniently assembled, or disassembled for repair. The base which is spiral in shape



SPIRALLY ARRANGED EXPOSED RESISTANCE UNIT

is made of insulating material, such as asbestos compound or the like, and is formed of any number of sections. These sections are cut away so as to form less than one turn of the spiral. The base is mounted on a tube of insulating material, such as mica. Partitions of insulating material, such as mica, are provided between the spiral turns of the insulating base. With the base these partitions form a spiral groove in which the resistance element is wound, the partitions thus spacing the adjacent turns of the resistance element.

Memphis' 600,000 Kw.-Hr. Vehicle Load

Confidence in the Electric Automobile, Liberal Policy Toward Users, Operation of a Central Garage, and Co-operation with Manufacturers Factors That Have Put 300 Electrics on Lines of Central-Station

BY O. H. CALDWELL

FOLLOWING up with energetic sales effort its conviction that the electric-vehicle charging load offers better business for the central station than any other class of energy-consuming appliance used by the private customer, the Memphis Consolidated Gas & Electric Company has in the last five years developed a vehicle-charging load that now annually consumes 600,000 kw.-hr., practically all of which is off-peak energy.

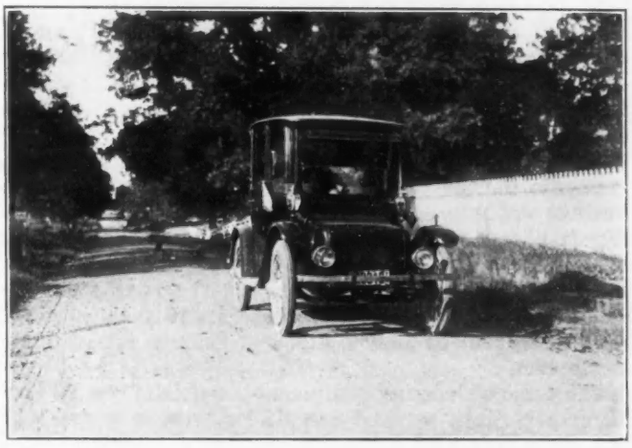
Three hundred electric vehicles are already in use on the streets of Memphis, a city with a white population of 90,000. Two hundred and forty-five of these are passenger cars and fifty-five are trucks. Users of electric passenger vehicles are met with on every hand, and the shopping district, residence streets and park drives of the city are to be seen filled with electric cars in all kinds of weather, for at Memphis as elsewhere the electric's convenience and comfort is demonstrated best of all on rainy and chilly days.

Moreover, in Memphis, where enthusiasm for the electric automobile is unconcealed, the belief among central station men, vehicle men, and vehicle users is that the electric passenger car has only begun to realize on the great opportunity for development before it, and it is confidently expected that a few years more of intensive work in Memphis will put the number of electrics there at 1000, with an energy consumption reaching 2,500,000 kw.-hr. per year.

GARAGE AND SERVICE POLICY

Several liberal development policies carried out by the Memphis central station company have led to this growth of the vehicle charging business from 30,000 kw.-hr. a year, as it was in 1910, to 600,000 kw.-hr., the consumption for 1916.

First of all, of course, electrics and electric-vehicle

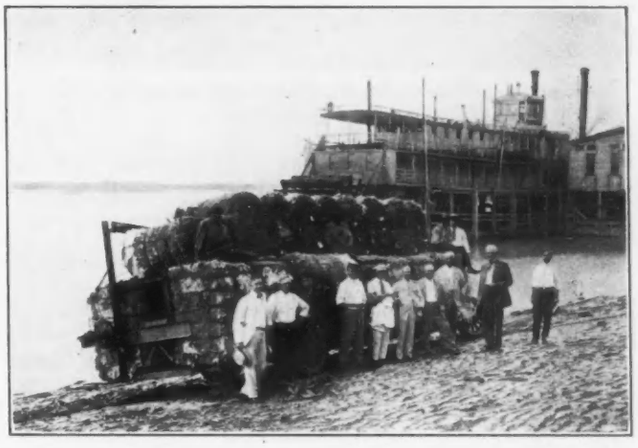


A SERIES OF ROAD RUNS TO NEARBY TOWNS HAS PROVED TO THE MEMPHIS PUBLIC THE DEPENDABILITY OF THE ELECTRIC PASSENGER CAR UNDER ALL ROAD CONDITIONS

performances have been kept in the public eye by energetic advertising in newspapers and on theater programs and motion-picture slides, in co-operation with the manufacturers.

In particular, however, every facility has been afforded the prospective customer to make it easy for him to buy his car and to provide for charging it, either in his own private garage (there are now 115 of these private charging outfits on the Memphis lines), or in the central garage operated by the company.

So successful has this policy of operating a vehicle garage proved as a practical means of stimulating vehicle growth, that the Memphis company last year doubled its garage investment and added more than 100



ELECTRIC TRUCKS ARE USED TO HAUL COTTON BALES ON THE MEMPHIS LEVEES

per cent floor space. The present garage represents an investment of about $12,000, an amount which, it is pointed out, equals roughly the investment in meters required to serve a group of small residence consumers taking approximately the same amount of energy as the present vehicle load.

"PAY-FOR-WHAT-YOU-GET" SYSTEM OF GARAGE CHARGES

The *a la carte* system of rates in use at the Memphis central station garage, where each customer pays only for the character and amount of service he wants, has been an important factor in the development of the vehicle load at Memphis. Expert battery and mechanical men, and careful garage attendants, also, are all essential factors in the plan to make the operation of customers' cars the success that they are to-day on the streets of Memphis.

The new garage of the Memphis Consolidated Gas & Light Company has a floor space of 25,000 sq. ft. and space for garaging 125 cars.

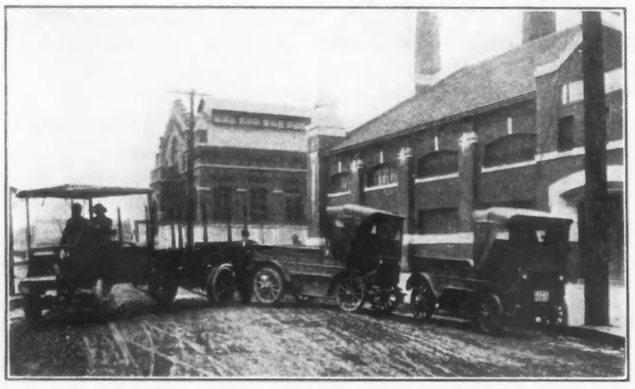
Under the *a la carte* plan of garage rates the truck or vehicle owner pays a "garage service" charge of $10 per month, which includes stabling, inspection of batteries and mechanical parts, flushing, cleaning, oiling and greasing, and the making of any adjustments in which actual replacement of parts is not required.

KILOWATT-HOURS METERED TO EACH VEHICLE

Direct-current energy to charge the car is separately metered by a watt-hour meter on each circuit, and the customer is billed monthly at 5 cents per kilowatt-hour for the energy consumed. Customers who have fleets of five cars or more are supplied with energy at 4 cents per kilowatt-hour.

For car-washing service a charge of $10 per month is made, which provides for washing up the car or truck each time it is returned to the garage from a run.

For $5 per month the garage management will send a boy to call for or deliver the customer's car to any



THREE ELECTRIC TRUCKS USED BY THE MEMPHIS CITY WATER DEPARTMENT

location in the city at any time of the day or night, as often as the customer may want to make use of his car.

Flexibility of Expense to Car User

Any owner of an electric may contract for as much of this garage service as he needs or wishes; as a result the cost to a customer who drives his car 100 miles or less a month, may be, for example, only $15 a month, while other users who run 900 miles or so, a month, have monthly bills in the neighborhood of $40.

Such a charge for electric-vehicle service represents, it is pointed out, probably about one-half the cost of operating a good gasoline car for the same service. The flexibility of the Memphis garage rate, it is emphasized, has brought the electric vehicle within the means of a large range of users, making of each an enthusiastic booster for the electric car.

The private owner who does not regularly use the company's downtown electric garage can, however, stable

THE CENTRAL STATION PRACTICES AS WELL AS PREACHES THE USE OF ELECTRICS

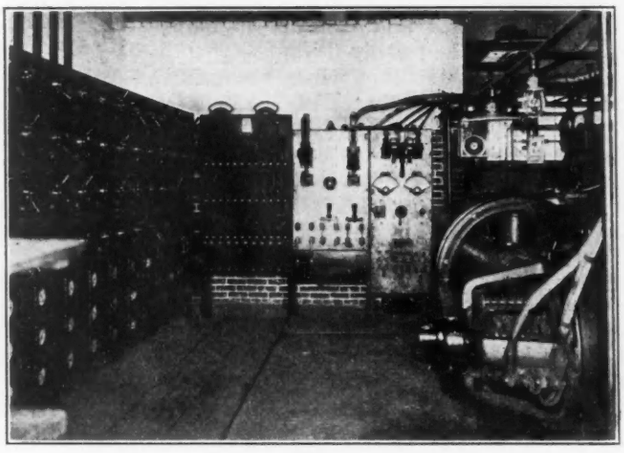
his car at the garage whenever he wishes, at a cost of only 25 cents for twenty-four hours. If the car is placed on charge the owner pays for energy at the rate of 5 cents for each kilowatt-hour consumed. Other items in the regular schedule of prices for such one-time service include flushing, 25 cents; washing, 50 cents to 75 cents, etc.

Batteries and electrical and mechanical parts are inspected and necessary adjustments are made without charge for any local electric vehicle owner whether a customer of the downtown garage or not, although it is the aim to render a nominal charge for any repair work which involves an outlay for labor or material. Such repair work must in each case be previously authorized by the owner, to whom a full report is made before such repairs are started.

Vehicle Inspection Service for Customers

Under the liberal policy of furnishing service to the owner, a great deal of minor repair work is rendered gratis. The aim is, above all, to see that the vehicle owner gets satisfactory operation from his car. The Memphis company also extends this free inspection service to customers who have private garages at their residences, and on call will send a man to inspect rectifier outfits, vehicles, etc., making adjustments or simple repairs necessary to restore service.

The garage represents an investment of about $12,000, although it is doubtful if it could be reproduced for that amount to-day. The central station garage has a monthly income of about $3,000 from regular garage service, repairs, etc. Fourteen men, including one clerk, are



CHARGING EQUIPMENT AND INDIVIDUAL RHEOSTATS IN MEMPHIS CENTRAL GARAGE

now employed in the garage department. The payroll amounts to $1,100 a month, and the monthly bill for electricity for charging averages $600. Water, and gas for heating the distilled-water generator, each average $50 a month.

It has been the aim throughout the operation of the Memphis garage plant to have the garage simply pay its own expenses, and as soon as a surplus is shown, service charges are adjusted to re-establish the balance. During the first year that the garage was established, a loss of $1,600 was sustained, but the next year the income balanced the expenditures. In 1915 the garage showed a profit of $3,000, and last year it again broke about even.

The garage charging equipment consists of one 75-kw. motor-generator set and one 75-kw. rotary converter. Charging energy is supplied to the forty charging plugs through an equal number of graphite-compression rheostats mounted on a switchboard in the generator room.

Co-operation With Manufacturers

One corner of the garage structure has been equipped with show windows and fitted up as a display room for Detroit Electric cars, manufactured by the Anderson Electric Car Company, with which the Memphis central station co-operates. Besides furnishing this display room, with telephone, light and heat, the central station

maintains and garages the demonstrating car used by the Anderson company's salesman at Memphis, pays one-third of the cost of the newspaper advertising, runs an advertisement in the program of the best theater, and advertises on the screen of the best motion-picture house. In return for this co-operation the manufacturer pays the central station 5 per cent on all local sales.

Along with the campaign to sell electric vehicles to new users, an effort has been made to bring up to date the electric car equipment already in use on the streets of Memphis, by substituting new cars for those already in use. Cars of the latest model are demonstrated to users who already know the advantages of electric vehicle operation, and the old but serviceable cars taken in on trades of this kind are then overhauled and disposed of to less discriminating purchasers, or to those who have still older models. This plan of overhauling and refitting used cars has also been very successful in modernizing and getting into service any cars that, through indifference or other causes, had been abandoned. In one instance, an early electric was removed from a hen coop where it had for some months served as a roost for the owner's chickens, and after being cleaned up, painted and overhauled in the company's garage, is to-day giving good service on the streets of Memphis. Dozens of other electric vehicles have been reclaimed by the central station garage in the same way and made into useful conveyances, each producing a regular income for the central station.

Carl K. Chapin, engineer for the Memphis Consolidated Gas & Electric Company in charge of commercial development, who organized the company's garage department and has supervised its operation from the beginning, believes that the vehicle load provides one of the most valuable classes of business the central station can obtain, its off-peak demand and large energy consumption making it, in his opinion, more desirable than even equivalent electric cooking business.

The operation of an electric vehicle garage, Mr. Chapin points out, is good central station business compared with the average residence, which uses its maximum demand the equivalent of barely fifty minutes daily. A private charging station for an electric vehicle averages a consumption equivalent to three hours' use of the maximum, while the public garage takes energy equivalent to ten hours' use.

Compared on a basis of energy consumption the installation cost of serving a residence having 250 watts demand and a monthly consumption of 40 kw.-hr. per kilowatt of maximum demand, is $190 per kilowatt; a private vehicle charging outfit consuming 66 kw.-hr. per kilowatt of maximum demand, $75 per kilowatt; and public garage consuming 360 kw.-hr. per kilowatt of maximum demand $15 per kilowatt.

GIVING ELECTRIC VEHICLE FAIR SHARE OF DEVELOPMENT EFFORT

In Memphis the central station company is proving its belief that the electric vehicle is justified in having as much or more effort concentrated on its development as upon any other branch of new business.

If the average electric car consumes 200 kw.-hr. per month, this means for the central station five times the amount of electricity sales that the same private-residence user would take for all other purposes. And in spite of the low rate offered for electric charging service, as a result of its off-peak and all-night character, the presence of the vehicle usually actually triples the revenue derived from the household as a whole.

THE CENTRAL STATION ELECTRIC GARAGE AT MEMPHIS AFFORDS SPACE FOR TAKING CARE OF 125 VEHICLES AND TRUCKS

At the present time, therefore, there seem to be no other current-consuming mediums which offer such opportunities for expansion and development in the residence field.

Manufacturers of electric passenger cars, it is pointed out, are willing to go farther in their co-operation with the central station than most other manufacturers of electricity-consuming appliances or apparatus, and they should be encouraged to the end of securing for the central station and for themselves all possible results from this condition of co-operation.

The future of the electric automobile in a city like Memphis need concern no one when there is in evidence such a satisfactory development as that at present, on which to base expectations for the future. On the other hand, it is pointed out, the central station, in the face of constantly lowering average rates, must depend on utilizing every possible natural advantage to increase its output in a greater proportion than the investment in the business is increased, and in this development of better load-factor business, the electric vehicle, according to the Memphis view, is bound to offer a more valuable opportunity than any class of residence load.

Associated Manufacturers Meet and Work

Annual Gathering in New York, Followed by a Banquet, Reviews the Extensive Co-operative Effort of the Makers of Electrical Supplies and the Growth and Bright Prospects Ahead

PRIDE in their successful co-operation and enthusiastic and cordial support in the work of the Associated Manufacturers of Electrical Supplies were in the atmosphere of the second annual meeting, held last week at Delmonico's, New York. The business session was held in the afternoon of March 15, and the banquet, with 185 present, was in the evening.

As stated in last week's issue of the ELECTRICAL WORLD, President Robert K. Sheppard was kept at home by illness. In his absence his report was read by the vice-president, H. B. Crouse, Crouse-Hinds Company, Syracuse, N. Y. An abstract of the address of Mr. Sheppard was published in the ELECTRICAL WORLD of March 17, 1917, page 524. Mr. Crouse asked Thomas M. Debevoise, general counsel of the association, to preside over the meeting. A telegram, expressing regret at the sickness of Mr. Sheppard and hope for his speedy recovery, was sent to him.

J. F. Kerlin, National Carbon Company, presented the report of the finance committee, which showed all indebtedness paid and a cash balance on hand. The committee felt that it was indicative of the efficiency of the treasurer, J. W. Perry of the Johns-Manville Company, as well as of the interest of members in the welfare of the association, that there were no unpaid dues on March 1, the date of its report.

Associated Manufacturers Getting Results

The finance committee found no unpaid dues.

There are 156 member companies, with 256 executive and associate representatives.

Standardization of design and stabilizing statistical work accomplished.

Fifteen sections organized and others under consideration.

More than 100 meetings held during the year by sections or committees.

Uniform cost accounting idea making progress.

Standardization of sizes of literature being discussed.

An extended investigation of electric wiring systems under way.

One hundred per cent membership the aim.

A tariff committee will be appointed.

REPORT OF CHARLES E. DUSTIN, THE GENERAL SECRETARY

Charles E. Dustin, the general secretary, gave a brief outline of the volume of work which has passed through the office and said that he found it very difficult to show all that has been accomplished for the welfare of the industry or to give credit to the many zealous workers who have given time and unceasing efforts in a desire to better conditions.

At the organization meeting, said Mr. Dustin, ninety-three companies signified a desire to become members, and these were enrolled as charter members. Three of these failed to qualify and nine decided that their special line of manufacture did not conform strictly to the requirements of the constitution, consequently the original membership really consisted of eighty-three manufacturers. To-day there are 156 member companies, with 256 executive and associate representatives. Mr. Dustin added:

"There are now fifteen sections, five having been organized during the past year, covering fan motors, attachment plugs, lighting fixtures, line material and carbon, all of which have been formed by special request of the manufacturers interested. Other sections are under consideration, but the general policy has been to extend the activities of the sections already formed, giving to the members an opportunity to standardize their products, and to encourage co-operation among the different manufacturers in their special lines, rather than to increase the number of sections until they could be handled to the advantage of those interested.

"Many lines of activities have been undertaken by the sections during the year, and after acting upon the ordinary topics of standardization of design, as well as matters of interest with the Underwriters' Laboratories, many of the sections have now specifically taken up the compilation of statistics pertaining to product handled by the members, figures being first submitted to the general secretary and tabulated by his office and the net results given to each of the members, without disclosure of the name of the individual manufacturer.

"Much progress has been made by co-operation of the manufacturers in the matter of a uniform basis for figuring costs. For this purpose articles manufactured by different members have been specified and costs submitted through the office of the general secretary. It is interesting to note that these figures have shown a variation of from 25 per cent to 40 per cent, indicating an improper distribution of expense items, and proving conclusively the necessity of adopting a uniform basis of cost accounting.

"In each section a cost accounting committee has been appointed. These committees are working on systems applicable to the products of their own particular sections, but no reports have been made or adopted, as it was thought wise to withhold all reports of these committees, pending the report of the cost accounting committee of the Electrical Manufacturers' Council.

"In the fuse section a standard for cartridge inclosed fuses has been prepared, which has resulted in a standard being approved by the Underwriters and the recommendation made that it be adopted as standard in the National Electrical Code, as issued by the National Fire Protection Association. I might say that the preparation of the fuse manual has involved an expenditure in cash of $940, which was borne by ten members of the fuse section, to say nothing of the valuable time given by the members of the committee.

"In the molded or formed insulation section a committee was appointed to consider a standard method for testing molded insulation, and a bulletin has been issued known as Standards Committee Bulletin No. 1, the first of a series to cover all the important properties of molded insulation. A brief reference to this bulletin in one of the electrical papers has brought requests from the leading scientific societies of this country and

Europe for copies, and this will testify to the interest which is being taken in this work and its value to the insulation industry.

"A great diversity in the method of handling its product led one of the sections to consider a list of customs of the trade. Naturally this involved a long and varied discussion, but in the end a list of customs was approved and recommended for adoption, although not in any way obligatory upon the members, all tending to mitigate many of the evils peculiar to that particular branch of the industry."

REMARKS OF T. M. DEBEVOISE, GENERAL COUNSEL

Mr. Debevoise said in his remarks to the members:

"The work has gone on well and the plan of organization is proving excellent. We have been able to effect some changes, making it more workable, but very careful check has been kept on everything and everything that has been done has in my opinion been legal and proper.

"A few things have had to be done over and a few questions reconsidered—in fact, there are legal questions coming up almost constantly, but nothing has gone through which we have regretted, and I think we can say at the end of the year that the association has found methods of co-operation which are perfectly safe and which I believe you will agree are of the greatest advantage to the members.

"It has been a very interesting organization period. Now that period is over. The organization of the future will be devoted to bringing new sections into line and increasing the membership of the sections that are already parts of the association, but the new sections will be organized on the lines of the old. It was impossible to tell you at the beginning just what would be done, but I hope as the association goes on we will find new fields of activities which will prove just as valuable as those discovered to date."

DELEGATION TO ELECTRICAL MANUFACTURERS' COUNCIL REPORTS

D. Hayes Murphy, American Conduit Manufacturing Company, chairman of the association's delegation to the Electrical Manufacturers' Council, reported in part:

"One of the subjects now under consideration, for example, is the question of standardization of sizes of literature for the electrical manufacturing industry. A committee has been appointed by the council with instructions to confer with like committees appointed by the Electrical Manufacturers' Club, Electric Power Club and the Associated Manufacturers of Electrical Supplies for the purpose of assembling all available data on the subject and making such recommendation as seems proper.

PROGRESS IN COST ACCOUNTING

"Perhaps the most important subject which has been considered by the council is uniform cost accounting. Chairman S. L. Nicholson of the council invited C. E. Patterson, comptroller of the General Electric Company, to be present at the July 17 meeting for the purpose of giving the council the benefit of his advice on this question. Mr. Patterson outlined a plan for working out a uniform cost accounting system for the electrical manufacturing industry. The uniform cost accounting committee, with Mr. Patterson as chairman, was then appointed, with instructions to start work at the earliest possible moment."

The results accomplished are summed up briefly in a letter from Mr. Patterson to Edward N. Hurley, chairman of the Federal Trade Commission, dated Jan. 23, 1917. Mr. Patterson's letter, as submitted by Mr. Murphy in the report from the delegation to the Electrical Manufacturers' Council, follows in part:

"The committee has worked steadily throughout the year. Its members include representatives who are accounting experts of large and small companies. The committee was also selected with due recognition of the diversification of manufacturing products and conditions. As a result of its work we are able to submit to the Federal Trade Commission outlines which we believe have been so planned that they not only conform to the requirements of scientific accounting and an adequate cost system, but are sufficiently flexible so that they may be used to advantage by both large and small manufacturers.

"Through their work the committee has kept in touch with your chairman of the commission and has felt that its efforts were directed along lines which harmonize with the progressive policy adopted by the commission."

CHAMBER OF COMMERCE MEMBERSHIP

Hjalmer Hertz, Diehl Manufacturing Company, was unable to be present to read his report as national councilor of the association to the United States Chamber of Commerce. Mr. Debevoise read two letters from Mr. Hertz, giving his views on the value of the work.

COMMITTEE ON ELECTRIC WIRING SYSTEMS

LeRoy Clark, Safety Insulated Wire & Cable Company, made a report for the committee on electric wiring systems, of which he is chairman. This committee is the development of what was started as the committee of business and technical experts, which was appointed at a meeting of the manufacturers in December, 1914. That committee has been enlarged gradually. At the start its work primarily was the consideration of the subject of concentric wiring, but it soon developed that that was too narrow a subject, and in order to do better work it was enlarged to include all of the representative electrical bodies. The work became an investigation of wiring systems, with the possibility of developing some system of wiring which would be not only cheaper, but safer from the viewpoint of life and fire.

Mr. Clark added that the committee now has representatives from the following organizations, aside from the manufacturing representatives who have been on it from the start:

National Electric Light Association, Western Association of Electrical Inspectors, International Association of Municipal Electricians, American Institute of Electrical Engineers, Associated Factory Mutual Fire Insurance Companies, Underwriters' Laboratories, Inc., Bureau of Standards, Electrical Supply Jobbers' Association and National Electrical Contractors' Association.

In addition, said Mr. Clark, the committee has two technical experts, Gano Dunn, J. G. White Engineering Corporation, and D. C. Jackson, Massachusetts Institute of Technology. During the last year the work has been confined entirely to the work of a sub-committee investigating the subject of bare grounded return wiring systems. Wiring systems would be naturally divided into two classes, insulated systems and partially insulated systems. Concentric wiring was only one of the possibilities in a grounded return system, therefore the committee considered not only concentric wiring, but any form of bare grounded return wiring system.

C. E. Corrigan, National Metal Molding Company, chairman of the sub-committee on bare grounded return wiring systems of the committee on electric wiring systems, presented the sub-committee report.

THE SECTIONS

No formal reports were made by the sections generally. E. B. Hatch, Johns-Pratt Company, chairman of the molded or formed insulated section, spoke informally.

ONE HUNDRED PER CENT SOUGHT IN MEMBERSHIP

R. E. Gallaher, New York Insulated Wire Company, spoke of the desirability of increasing the membership still further. The campaign for new members is now in charge of the various sections. It is the aim to have the full manufacturing output in each field in the respective sections.

FOR PROTECTIVE ACTION ON THE TARIFF

L. Livingston of Edward F. Caldwell & Company spoke of the importance of action by the association on the tariff question. He said that the present duty on fixtures is 20 per cent. Prior to the reduction of the tariff it was 45 per cent. It has been stated in authentic sources that certain foreign manufacturers were able to bring influence to bear to promote this reduction, which was of assistance to them.

When this reduction was under consideration, said Mr. Livingston, manufacturers did not take an interest in maintaining the duty at 45 per cent. He spoke of the efficiency of war-trained workmen in Europe and of the wastefulness and higher wage scales in this country, and urged that a committee be appointed to present statistics to the Tariff Commission in order that the tariff might be so equalized as to put the American manufacturer on the same basis as the European manufacturer.

It was decided to have a general committee.

GOVERNORS RE-ELECTED

Five members of the board of governors whose terms expire were re-elected for three years, from April 1, 1917, as follows: A. W. Berresford, Cutler-Hammer Manufacturing Company; L. W. Downes, D & W Fuse Company; E. B. Hatch, Johns-Pratt Company; B. E. Salisbury, Pass & Seymour, Inc.; R. K. Sheppard, Simplex Wire & Cable Company. The board will elect officers later.

PATRIOTISM AT THE BANQUET

Decorations in the banquet room in the evening were in keeping with the patriotism which characterizes the times. Every one present had a tiny flag and the flags and national colors were draped over the speakers' table, while in the center electric lamps blazed the initials of the association. During the evening the guests drank a toast to the President of the United States and patriotic songs were sung. Mr. Debevoise was the toastmaster, and the speakers were Edward N. Hurley, retiring chairman of the Federal Trade Commission, and the Hon. Job. E. Hedges. Mr. Hurley discussed the question "Are We, as Business Men, Doing Our Duty?" Mr. Hedges made a stirring patriotic address.

ARE WE DOING OUR DUTY AS BUSINESS MEN?

Mr. Hurley traced the development of the cost accounting movement in the commission and then took up the subject of the duty of business men to safeguard their own interests. He said in part:

"Is it fair to the President of the United States, the Governor of our State and our Congressmen, that business men, who are directly concerned regarding legislation and laws that have been enacted, or are to be enacted in the public interest, continue to be indifferent towards these measures by not giving them any attention or support? How can business men intelligently criticize government unless they pay some attention to these important questions and are familiar with the facts?

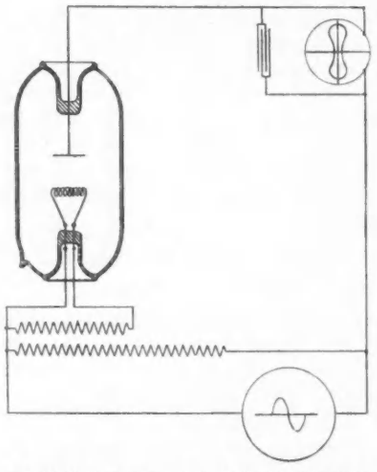
"We must not allow our prejudice, no matter what party is in power, to affect or bias our better judgment. We must be business men first and partisans second. If we do this, I know that we will be better business men and our country will profit by our counsel and advise.

"One of the real needs among American business men to-day is a broad view of business and a comprehensive grasp of industry as a whole. Too many American manufacturers and merchants center all their energy and attention upon their particular establishment and the work of making profits for it. Men at the head of factories need the point of view of what might be termed as the 'statesmanship of business.' They need to appreciate the fact that their plant is only a part of a great industry; that their individual welfare depends very largely upon the welfare and progress of the whole industry and of industry in general."

CREST VOLTAGE INDICATOR

Method Whereby Reading Is Maintained Long After Puncture Pressure Is Established

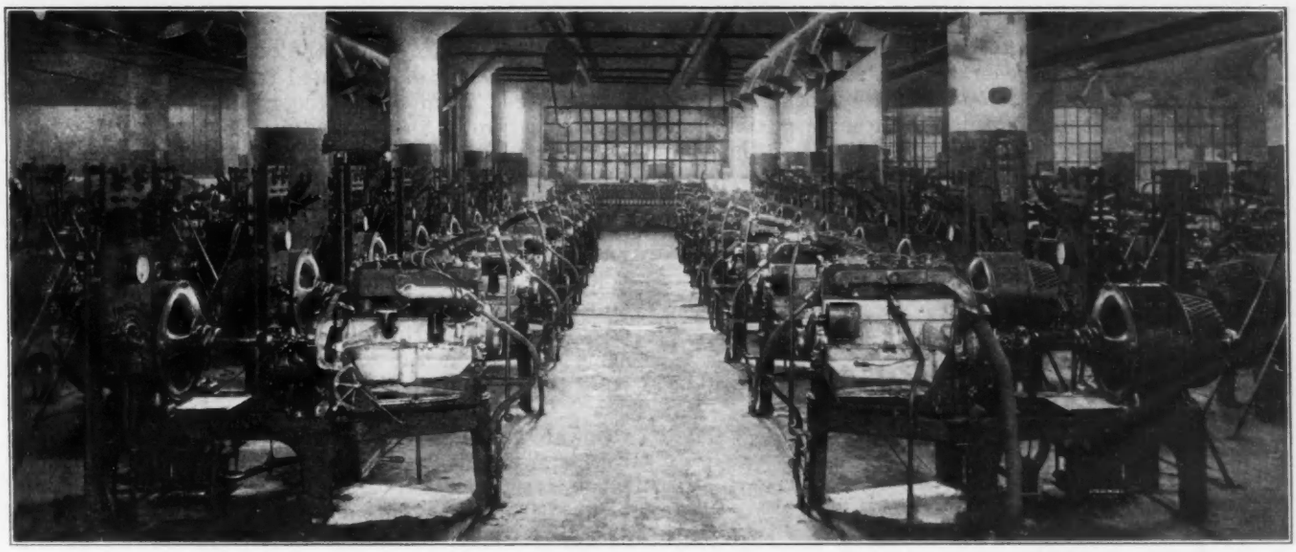
In testing insulating materials for dielectric strength or puncture value, where it is probable that the maximum value which causes the breakdown depends on the wave form it is often desirable to know the maximum or crest value of the alternating voltage wave. In patent No. 1,209,766 Dr. Clayton H. Sharp, director of the Electrical Testing Laboratories, New York, discloses a very effective method by which a crest-voltage indicator can be made to maintain its reading for a considerable period after the puncture pressure has been established.



ARRANGEMENT OF FLEMING VALVE, CONDENSER AND VOLTMETER FOR CREST VOLTAGE MEASUREMENTS

A Fleming valve of the general type used in wireless work is placed in series with an electrostatic voltmeter connected across an alternating-current line. If the current through the valve during the first quarter cycle has not been sufficient to raise the potential of the voltmeter to the full-peak voltage of the wave a certain amount of electricity will flow into the voltmeter during the fifth quarter cycle of the voltage wave and similarly a smaller amount may flow during the ninth, thirteenth, etc., quarter cycles until the potential indicated by the voltmeter has become the same as that of the peak of the voltage wave. Thereafter no current will exist except such as may be necessary to supply the leakage from the voltmeter and connected apparatus shown.

It has been found desirable to place a condenser having a considerably larger electrostatic capacity than that of the ordinary apparatus in parallel with the voltmeter in order to serve as a storage reservoir of charge flow. Both the condenser and voltmeter then become charged to the maximum voltage of the wave and the voltmeter will indicate this value in volts. If, when this condition has been obtained, the voltage on the line is for any reason reduced as, for example, by the puncture of insulating material under test, the voltmeter needle will retain its maximum position, dropping back toward zero slowly at a rate which depends upon the capacity and the leakage.



Engine Testing Made Cheaper and More Rapid by Electricity

How the Testing Department of a Toledo Automobile Plant Improved Its Facilities and Was Made Self-Supporting by the Adoption of Electrical Methods on a Large Scale

WHILE there is nothing particularly new about employing electric generators to load gasoline engines under test, the engine test room of the Toledo plant of the Willys-Overland Company is interesting because this method has been used so extensively. In addition the control arrangements are novel.

The test room, which is 120 ft. square, contains 100 engine testing stands arranged in ten rows of ten stands each. Each set includes a 10-hp. 500/1200-r.p.m., 230-volt, direct-current Westinghouse type S.-K. shunt-wound generator, semi-inclosed on the commutator end and a panelboard carrying control equipment and an ammeter. A single feeder connects each row of these sets to as many busbars at the main switchboard through a 400-amp. circuit breaker. The buses of this board are in turn fed from a 200-kw. motor-generator set or from a 300-kw. rotary converter housed in one of the company's substations. The line from the main buses to the motor-generator set passes through a 1200-amp. circuit-breaker set to trip at 1600 amp. The 300-hp. synchronous motor of the main motor-generator set receives its energy, when the set is supplying power to the test room, from the lines of the Toledo Railways & Light Company, and delivers power back to the central station system when the energy generated in the test room exceeds the local requirements. A commutator-type, 230-volt direct-current General Electric watt-hour placed on the main switchboard and connected in the main motor-generator circuit, records incoming and outgoing energy.

The direct-current motors were selected for this service because they afforded the wide speed range necessary in testing. Induction-type motors were tried in this service, but proved less satisfactory than the direct-current machines. Two hundred and thirty volts was chosen as the potential because a motor-generator set designed for this pressure was on hand and could be used advantageously in this work. The cycle of operations practically fixed the speed range of the motors between 500 and 1200 r.p.m. The semi-enclosed construction on the commutator end of the machines was considered desirable to eliminate troubles which might occur from falling material, overhead crane hooks and the like.

The cycle of testing operations is of interest since it shows what a large amount of work must be done on and by a gasoline engine in the electrical "limbering up" process employed in this plant. When the engines arrive at the test room they are completely assembled, even the automobile clutch being attached to the shaft. They are set on the concrete testing blocks by a traveling, motor-operated, Sprague hoist. After the testing motor is brought up to a speed of 500 r.p.m., (when the resistance has all been cut out of the armature circuit) the automobile clutch is closed thereby coupling the engine shaft to the revolving direct-current motor. The flywheel effect of the motor is sufficient to do what the factory men call "break the set in the bearings"; that is, overcome the high static friction which exists in a new engine despite the fact that the bearings are given a preliminary run before the engine is tested.

"Breaking the set in the bearings" overloads the direct-current motor about 300 per cent for a period of from one to three minutes, after which the load drops to normal. The motor is then allowed to drive the engine at 500 r.p.m. for about 30 minutes, when the load will have decreased to about 20 per cent full-rating of the direct-current motor. The speed is then increased to 700 or 800 r.p.m., and the set operated for one hour to one and one-half hours, depending on the condition of the engine. This process of driving the engine is called "running in," in factory parlance.

After a period of another one and one-half to two hours, artificial gas is admitted to the engine intake manifold through a mixing valve, the magneto switch is closed, and the engine is allowed to drive the direct-current machine, as a generator. An adjustment in the throttle valve is made at this time to regulate the load carried to about 25 amp. This current is maintained for one-half hour to one hour; then the speed

is increased to a value between 800 r.p.m. and 1200 r.p.m. to load the unit to 50 amp., the full-load rating of the direct-current generator. After a full-load run of one-hour the engine is taken off the block.

To control the equipment in these operations and provide automatic protection against contingencies which might arise, the following methods and arrangements have been employed. The direct-current motor of each set is brought up to a speed of 500 r.p.m. by cutting resistance out of the armature circuit, and its speed is increased beyond that point to 1200 r.p.m., by inserting the same resistance in the shunt-field circuit. Circuit protection at each set is afforded by a single-pole circuit breaker in each side of the line. One of the breakers is set to open on 400 per cent overload and is expected to open only on short-circuits. The other is set at 125 per cent overload. When the automobile clutch is closed to "break the set of the bearings" it is necessary to hold the low-set single-pole breaker closed, thus the operator is required to stay beside a unit until the "set has been broken" and the load has dropped to the rating of the motor.

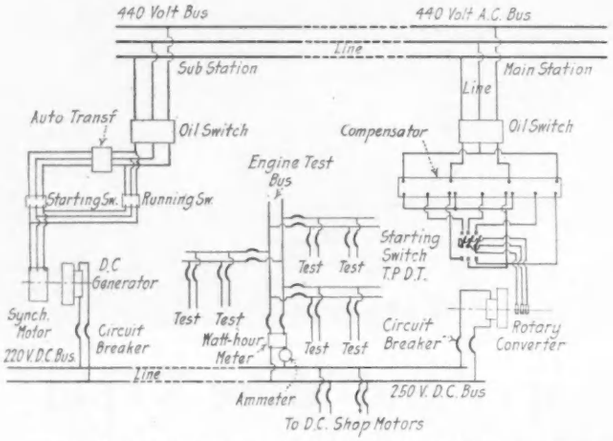


FIG. 1—CONNECTIONS OF ENGINE-TESTING CIRCUITS

Each of the single-pole breakers is equipped with a special contact so that when a breaker opens, it also opens the no-voltage release circuit on the direct-current motor starter, allowing the handle thereof to swing to the "off" position. When the handle reaches this position it closes an auxiliary switch which short-circuits the engine-driven, high-tension magneto through a ground thus preventing ignition of the gases. Without this arrangement the set would continue to operate after being disconnected from its load, and might be damaged from over-voltage and high centrifugal strains set up by the ungoverned engine.

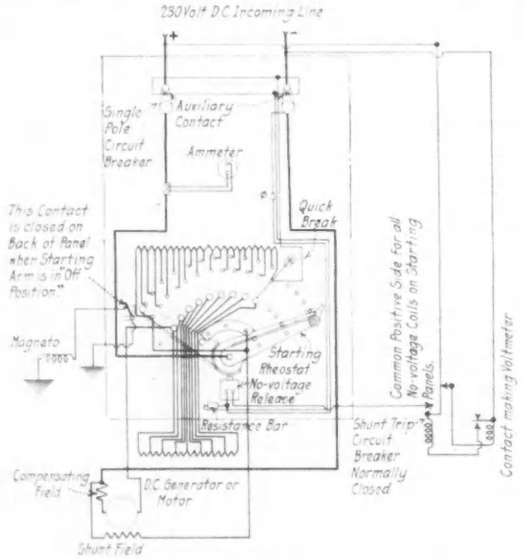

230 Volt D.C. Incoming Line
Single Pole Circuit Breaker
Auxiliary Contact
Ammeter
This Contact is closed on Back of Panel when Starting Arm is in Off Position
Quick Break
Magneto
Starting Rheostat
No-voltage Release
Resistance Bar
Common Positive Side for all No voltage Coils on Starting Panels.
Contact making Voltmeter
Shunt Trip Circuit Breaker Normally Closed
Compensating Field
D.C. Generator or Motor
Shunt Field

FIG. 2—WIRING OF CONTROL PANEL

To avoid a somewhat similar case of trouble, which would occur if the large motor-generator set failed with a large number of the smaller units pumping into it, a contact-making voltmeter has been placed in the main motor-generator circuit. If a set starts to race the voltmeter closes a contact actuating a shunt-trip circuit breaker which, in turn opens the no-voltage release circuits on the entire 100 sets. This operation has the same result as in the former case, that is, it short-circuits the magneto and stops the engines. Three emergency push-buttons located in various parts of the test room are connected in multiple with the contact-making voltmeter circuit, so that the entire plant can be stopped if necessary.

Since the energy output of the test room exceeds the energy consumed, efficiency was not the controlling factor which prompted the selection of the testing equipment used. The chief requirements were increased production, a better product, and decreased maintenance cost of test equipment. As for increased production, 100 per cent more engines were tested by the electrical method with less labor expense than by the old belt-and-jack test method. The absence of belts also improves the factory appearance, increases safety to employees and reduces noise. The electric testing equipment also facilitates mounting engines, it taking only two minutes for two men to set up a four-cylinder engine ready for test. The ammeter in the electrical circuit is an added convenience for the testers, since rapid fluctuation of the needle indicates that a cylinder is "missing fire." These conveniences with the quieter test room aid in "sounding out" motors, and thus insure higher quality in the product.

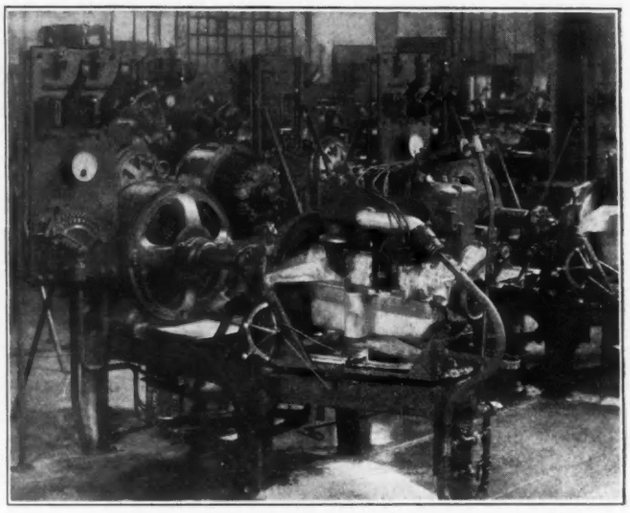


FIG. 3—ENGINE MOUNTED FOR TESTING

Although no accurate maintenance costs with the belted equipment are available, men who have been in test-room service for a long time declare that the two systems are not even comparable on this score. With the belted units there was nothing but trouble and expense. On the other hand during the two years that the electrical testing units have been operated there has been no trouble and practically no maintenance expense aside from lubrication.

Saving of energy, ordinarily wasted in brake tests, was of course one consideration in selecting the electrical equipment. With the test room running at full

capacity about 400 engines have been tested in a nine-hour day. During a period of this length from 200 kw.-hr. to 250 kw.-hr. will be pumped back either into the company's general direct-current network or into the lines of the central-station company. This energy is not produced inexpensively, however, since it originates from natural gas fuel burned in many comparatively small engines. The flow of energy at the end of a day is always from the test room—not toward it—notwithstanding the fact that all of the energy consumed by the crane hoists, exhaust fans, the mercury-vapor lamps and other auxiliaries is charged to the test room.

Seventy similar sets have been installed at the Elyria (Ohio) plant of the Willys-Overland Company for testing Knight engines according to W. A. Hill, electrical engineer for the company, since the Toledo installation has proved so satisfactory. One of the details in which the Elyria plant will be different, however, is the type of direct-current motor, since Knight engines require higher speeds in testing. At this plant a scheme will also be worked out for injecting steam into the exhaust header, so that fires which sometimes start therein can be quickly quenched.

The entire cost of the testing equipment and its installation at Toledo, exclusive of the large motor-generator set, which was on hand, was $40,000.

Electricity vs. Other Power for Coal Mines

Results Obtained in a Western Coal Mine by Changing from Steam to Steam-Electric Operation, with Data on Electric and Air Operation, and Cost of Using Locomotives in Place of Rope Haulage

BY CORNELIUS WEBER

HAVING been actively connected with the rehabilitation of a Western coal mine, especially from the motive-power standpoint, the writer will endeavor to point out how a change from steam to steam-electric operation affected the running expenses and output of the mine. In addition data will be presented to show how electric operation compares with air operation.

The mining company referred to was working two properties and opening a third. The first two were located 1 and 2 miles respectively from the power house and tipple, and in opposite directions from the latter. The power house, which was operated before steam-electric drive was adopted, included four air compressors and two hoisting engines directly connected to steam engines. The former furnished compressed air at 80 lb. pressure for operating the mining tools and equipment, and the hoisting engines were used to pull trains of coal cars from the mines to the tipple.

In addition to the apparatus in the main power house the following steam apparatus was used: One steam engine for operating the crusher plant and tipple, and one hoisting engine for pulling cars to the tipple (both engines operated by one engineer); one box-car loader engine, and two boiler and engine plants of 35 hp. each, one at each mine for operating ventilating fans. The latter plants each required three engineers on eight-hour shifts. Compressed air was delivered to the mines in opposite directions from the main plant through 8-in. mains. The air left the compressors at a temperature above boiling and cooled to the surrounding air temperature by the time it reached the mines. There the air was used for operating rock drills, coal-cutting machines or punchers and pneumatic pumps, the latter being ordinary steam pumps driven by air. An idea of operating conditions with steam drive can be obtained by an examination of the data in Table I. Interest, depreciation, etc., are not included in the expenses listed.

The condition under which electric service was adopted was that the local central station company should build and maintain an electrically driven air-compressor plant at its own expense and furnish electricity at 1 cent per kilowatt-hour. A 44,000-volt, 3600-kva. substation was built and motor-driven compressors were installed. Contrary to the original plans the old steam haulage system which pulled the coal trains with rope drives extending to the mines was retained, thus making it necessary to maintain a part of the original boiler plant. After the new power house was placed in service the operating expenses were as in Table II.

From the data given in Tables I and II it can be seen that a saving of $1,110.30 per month resulted by changing from steam to steam-electric drive, the items mostly responsible for the saving being the elimination of engineers and firemen and the reduction of coal consumed, which in round numbers cost the company $1 per ton on an average. In addition to this saving there was the elimination of interest, depreciation, insurance, etc., on a new plant which the mine operators would have had to build had they not accepted the proposition made by the electric service company. These items would have assumed considerable proportions.

TABLE I—MONTHLY OPERATING EXPENSES WITH STEAM EQUIPMENT

	Value of Coal Consumed	
	Working Days (26)	Idle Days (4)
Haulage system	$455.00	$46.00
Breaker plant engines	215.00	....
Steam heat and radiation	420.00	56.00
Electric light engine	237.00	36.00
Air compressor engines	1,475.00	85.00
Steam auxiliaries	14.00	1.00
Machine shop engine	7.00	....
Conveyor engine	27.00	....
Tipple engine and leakage	86.00	....
Ash-haulage engine	5.00	....
Total	$2,941.00	$224.00

	Labor Expense	
	Working Days (26)	Idle Days (4)
Firemen at $3.35 per day	$1,219.40	$80.40
Ash handlers at $2.90 per day	377.00	34.80
Water tenders at $3.35 per day	261.30	40.20
Boiler washer at $3.35 per day	87.10	....
Total	$1,944.80	$155.40

Supplies per month	$204.80
Engineers' wages per month	645.00
Additional labor, machinists, carpenters, etc.	540.30
Total	$1,390.10

Ventilating Fans in Two Mines

Value of coal for 26 working days	$175.00
Engineers' wages per month	625.00
Supplies per month	85.00
Total	$885.00
Grand total	$7,540.30

Since the steam-driven haulage plant was a source of great waste and inconvenience, the writer made a thorough investigation and prepared an estimate of the cost of installing electric locomotives, which is given in Table III, and of the saving that could be effected thereby, Table IV. From the figures given in Table IV it may be seen that an electric haulage plant, such as proposed, would have paid for itself in two years and would have permitted future saving in the total cost

of operation greater than the compressor plant could alone bring about.

While the changes made in the mine motive-power equipment can hardly be classed as complete electrification, they proved to have many advantages. At the time that this electrification was in progress the mining company was opening a third property. Electric drive was employed exclusively there and electricity was applied directly at the tools. High-tension alternating current was stepped down to 2300 volts to operate an induction motor which in turn was directly connected to a 250-volt direct-current generator serving the mine locomotives. The 2300-volt energy was stepped down to 440 volts to operate the tools and machinery.

Owing to the presence of iron pyrites, chain coal-cutting machines were not used, but electrically driven coal-punching machines, electric rock drills, electric pump motors, ventilating fans and an electric locomotive haulage system were installed. By the direct application of electricity at the various driven tools, great economy was obtained in power requirements and, for the greater part, labor items were eliminated. The electrically operated mine produced coal on a much smaller scale than the air-operated mines, owing to the fact that the latter were only being opened. However, even during the first stages of operation it was demonstrated that a high economy could be obtained with electric operation, as the comparisons in Table V show.

From these figures it may be observed that, with haulage included, the energy consumption is only a small part of that in the air-operated mines. It must also be borne in mind that in addition to the energy consumption charged to the air-operated mines there is the additional labor expense of operating the haulage system, which amounts to $10,556 per year or 2.9 cents per ton. It is apparent that the direct application of electric power at the machines and an electric haulage system greatly reduce the unit energy consumption, the total energy expense for the air-operated mines being $0.0817 per ton and for the electrically-operated mines $0.02385 per ton. The latter figure includes haulage, whereas the preceding figure does not. Furthermore, the unit energy expense of operating air mines should be increased by $0.029 per ton to cover additional labor, thus bringing the equivalent cost to $0.1407. In addition the electrically-operated mine requires no station operator, the motormen and blacksmith being selected to oil the machinery and operate the circuit breakers.

The installation of the electric machines, however, was not made without difficulty. In the first place the operators viewed the new machines with resentment. A man sent by the company which manufactured the machines was retained as a demonstrator. In one day he cut as much coal as an air-machine operator, the coal produced per machine being about 50 tons per day. All machine operators were paid on a square-foot basis, at the rate of $0.0205 per square foot for wide work and $0.0315 per square foot for narrow work. A certain minimum wage for these operators and helpers was established by the labor union. While hard-working air-machine operators could make a considerable amount in excess of this minimum wage, it was found that they could not cut as much coal when they shifted to the electrical machines as formerly, the result being that with a fair day's work they could not make much in excess of the established minimum. It was soon observed that these operators preferred to "take it very easy" and receive the minimum wage rather than exert themselves and make only a slight amount in excess of this minimum. As a result the coal production per man began to drop off, and it was found necessary to make a change in compensation rates for work done with the electric machines.

The reasons why the electric machines seemed to be more difficult to operate were their lighter weight and the fact that the pick moved through a fixed distance at every stroke. With air machines, on the other hand, the operators could feed their machines as fast as desired, the result being that the stroke would adjust itself. In the case of the electric machine, feeding too

TABLE II—MONTHLY OPERATING EXPENSES WITH STEAM-ELECTRIC EQUIPMENT

	Value of Coal Consumed	
Steam Plant	Working Days (26)	Idle Days (4)
Haulage system	$455.00	$46.00
Breaker-plant hoisting engine	9.00	....
Steam heat and radiation	420.00	....
Miscellaneous	40.00	95.00
Total	$924.00	$141.00
	Labor Expenses	
	Working Days (26)	Idle Days (4)
Firemen at $3.35 per day	$348.40	$40.20
Ash handler at $2.90 per day	75.40	....
Water tenders at $3.35 per day	174.20	13.40
Total	$739.00	$53.60
Supplies for the month		$145.00
Engineers' wages per month		312.00
Additional labor, machinists, carpenters, etc		550.00
Total		$1,007.00
	Cost of Electric Energy	
Electric Plant	Working Days (26)	Idle Days (1)
Breaker plant motor	$78.30	.....
Compressor motors (2)	2,680.00	$228.00
Machine shop motor	9.60	.....
Station lighting	9.00	1.50
Total	$2,776.90	$229.50
Supplies per month		$40.00
Engineers' wages per month		312.00
Additional labor, machinists, carpenters, etc		140.00
Ventilating fan motors		208.00
Total		$929.50
Grand total		$7,430.00

TABLE III—ESTIMATE OF THE COST OF INSTALLING AN ELECTRIC-HAULAGE SYSTEM

Based on installing a 500-volt direct-current haulage system 21,600 ft. long and designed to operate two 12-ton locomotives, one 15-ton unit and one 8-ton gathering locomotive.

Materials	
Overhead construction	$3,100.00
Switchboard	393.00
Switchboard accessories	82.00
Total	$3,575.00
Station Generating Equipment	
One 200-kw., direct-current, 500-volt (no load), 550-volt (full load), commutating-pole generator, direct-connected to 350-hp., 2200-volt, 60-cycle, three-phase alternating-current motor on common bedplate, and equipped with suitable starter	$3,600.00
Locomotives	
One 8-ton gathering locomotive	$2,220.00
One 15-ton locomotive	2,825.00
Two 12-ton locomotives at $2,480 each	4,960.00
Total	$10,005.00
Foundations for motor-generator set	$145.00
Freight	
Locomotives	$450.00
Motor-generator set	500.00
Switchboard	15.00
Line material and accessories	435.00
Total	$1,400.00
Labor	
Unloading motors and machinery and assembling machinery and switchboard	$200.00
Labor on line construction	700.00
Total	$900.00
Cost of strengthening present trestles to carry locomotives	$720.00
Grand total	$20,345.00

rapidly caused the machine to kick back and endanger the operator. Furthermore, the lighter weight of the electric machine tended to aggravate this disadvantage. A careful study of the whole situation revealed the fact that a good electric-machine operator could not compete with a good air-machine operator. However, raising the rate per square foot for the electric-machine operator was a great inducement for the men to exert themselves, and the results were very gratifying, as the data given in Table V indicate.

It was found that the electric rock drill was not capable of drilling as many holes as the air machine, also that the air machine was far more convenient to move around and set up. Much time and thought were spent to improve the machines and various kinds were tried, but none could do what the air machines were capable of doing. However, as the total cost of production was so materially reduced, this disadvantage of the electric rock drill was offset. The chief disadvantages of the electric rock drills are their excessive weight, bulk and complexities. The writer has the opinion that a big future would be in store for a successful drill that would consist of a plunger oscillated back and forth by two solenoids. Such a machine would have nearly all the characteristics of an air machine. Efficiency would not be a deciding factor in selecting electric drills, as the air drills are very inefficient.

All of the preceding data show the comparative costs of energy under various conditions without regard to the final cost of producing coal. Although conditions vary in the different mines, none of the mines referred to required shafts, as they had entrances from ground level. Loading was paid for on a tonnage basis. The only items affected by electric drive were energy costs, machine operation, labor and haulage. The electrically operated mine produced only about 150 tons of coal per working day, while the air-operated mines, which were well developed, produced about ten times this amount. Consequently, the smaller mine had relatively high overhead charges and could hardly be expected to produce as cheaply under ordinary conditions as the larger mines. However, the labor and energy costs in the case of electrical operation on a small scale are actually lower than the same items in the case of air operation, as data in Table VI will show.

When the figures in Table VI were compiled the electrical mining machine operators were receiving a fixed wage per day on account of the fact that a rate adjustment was in progress. The result was that the machine operators did not work as ardently as usual, produced less coal, and naturally increased the cost per ton. The cost per ton ($0.321) is therefore higher than normal. If haulage expenses could have been included the difference would be far greater.

Since the mines referred to in this article were equipped a chain-type cutting machine capable of operating any fields in which iron pyrites are much in evidence has been developed, so the disadvantages cited above for electrical coal cutters will undoubtedly be overcome. With the remarkable results mentioned in this article and with purchased power at 1 cent per kilowatt-hour balanced against steam operation, it is quite possible that a modern electric generating plant which is located at a coal mine would prove to be a good dividend payer.

TABLE IV—ESTIMATE OF SAVING THAT COULD HAVE BEEN EFFECTED BY REPLACING ROPE-HAULAGE WITH AN ELECTRIC LOCOMOTIVE SYSTEM

Labor Items Eliminated

No. of Men	Classification	Rate Per Day	Total Per Day	Days Per Year	Total
2	Trip riders	$3.75	$7.50	240	$1,800.00
1	Rope cutter	3.15	3.15	240	756.00
2	Connection men	3.40	6.80	240	1,632.00
1	Rope splicer	3.75	3.75	365	1,368.75
2	Pulley repairers	3.75	7.50	240	1,800.00
5	Drivers	3.15	15.75	240	3,780.00
3	Firemen	3.35	10.05	365	3,668.25
2	Engineers	4.00	8.00	365	2,920.00
	Total per year				$17,725.00

Labor Items Introduced

No. of Men	Classification	Rate Per Day	Total Per Day	Days Per Year	Total
4	Motormen	$3.60	$14.40	365	$5,256.00
1	Helper	3.40	3.40	300	1,020.00
	Total per year				$6,276.00

Miscellaneous Items Eliminated		*Miscellaneous Items Introduced*	
2400 tons coal at $1 per ton	$2,400.00	Electrical energy	$2,400.00
Feed for five horses	550.00	Oil for locomotives	200.00
Oil for pulleys	400.00	Depreciation on locomotives	500.00
Depreciation on rope	1,200.00	Depreciation on motor-generator	200.00
Depreciation on pulleys	600.00	Brakeshoes	500.00
General repairs	200.00	Other repairs	300.00
Total	$5,350.00	Total	$4,100.00
Grand total of items eliminated	$23,075.00	Grand total of items introduced	$10,376.00

Annual saving = $23,075—$10,376 = $12,669.

TABLE V—COMPARISONS OF OPERATING CONDITIONS IN AIR-OPERATED AND ELECTRICALLY EQUIPPED MINES

Compressed Air Mines (Motor-Driven Compressors)	
Tons of coal produced per working day (average)	1,485
	Kw.-hr.
Compressors	228,000
Crusher plant	3,750
Fans	13,470
Slack coal conveyor	820
Lighting	1,650
Total	247,690
Tonnage produced per month (average)	30,300
Unit energy consumption (in kilowatt-hours per ton of coal produced) (average).	
Compressed air	7.52
Crushing	0.123
Ventilation	0.444
Miscellaneous	0.08
Total	8.168
Average coal consumption (in pounds per ton produced):	
Previous to electrification	114.4
After electrification	27.2
Ratio of power-plant labor expense after electrification to same expense before electrification	60.6
Electrically Operated Mine	
Tons of coal produced per day	4,444.3
Energy consumption in kilowatt-hours:	
Mining machines—drills, pumps and electric hoist combined	3,290
Ventilating fan	1,675
Haulage system	5,725
Total	10,680
Unit energy consumption (in kilowatt-hours per ton of coal produced:	
Mining machines, drills, pumps and hoist	0.718
Ventilation	0.377
Haulage	1.29
Total	2.385

TABLE VI—MACHINE LABOR AND ENERGY COSTS FOR ONE MONTH

Air-Operated Mines	
Wages of machine men, drillers and helpers	$4,872.00
Wages of power-plant operators and mechanics	500.00
Cost of electrical energy to operate air compressors and fans	1,632.00
Total	$7,004.00
Number of tons of coal produced	20,737
Cost of above items per ton	$0.338
Electrically Operated Mines	
Wages of machine men, drillers and helpers	$1,377.55
Cost of electrical energy, mining machines, pumps and drills	32.00
Ventilating fan	16.00
Total	$1,425.55
Number of tons of coal produced	4,444
Cost of above items per ton	$0.321
Balance in favor of electrically operated mine (per ton)	$0.017

STATION AND OPERATING PRACTICE

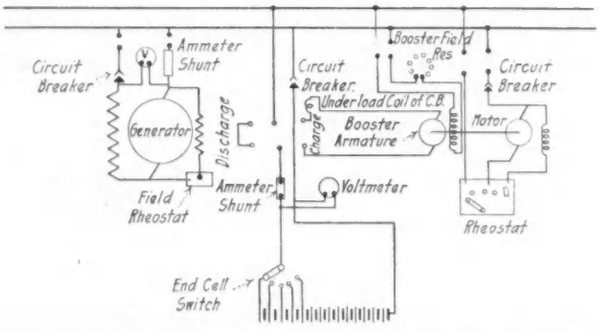
A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

REMEDYING BOOSTER TROUBLE

Straightening Mix-up in Connections and Changing Method of Excitation, Corrected Polarity and Voltage

BY H. L. HERVEY

While the wornout commutator of a booster armature, which had been in constant service for eighteen years, was being replaced, the old and brittle coil insulation was accidentally cracked by moving the coil leads. As soon as the machine was started a number of short-circuits developed, necessitating the rewinding of the armature. Since the pitch had not been counted before



CONNECTION OF BOOSTER WITH SUPPLY AND BATTERY CIRCUIT

the commutator was disconnected the first time, it was necessary to determine the coil throw. As there were ninety-one wave-wound coils the lead pitch had to be either 1 to 46 or 1 to 47, depending on whether a retrogressive or progressive connection was used. Both connections would work satisfactorily, but the polarity of the generated emf. would be different for the two connections. To experiment a retrogressive connection of 1 to 46 was used. In disconnecting the booster another obstacle was introduced by the engineer neglecting to mark any of the connections. When the machine was started with the new armature, the polarity built up in the wrong direction, showing that a progressive connection should have been used. After the engineer had made several changes in the external connections of the booster without getting the correct combination, the writer was called in to locate the trouble.

On starting the set the voltage rose in the right direction, so the generator was connected to the battery. Instead of obtaining a charging current of 40 amp., however, the highest that could be obtained with all the resistance cut out of the field rheostat was 25 amp. This condition indicated a reversed series field connection. After reversing the series field, the load was again connected, but the ammeter needle went off the scale, showing that the machine was too highly over-compounded. The series winding was then cut out, leaving a separately excited shunt-wound booster. It is not known whether the series coils were in use before the machine was taken down or not, but since they were cut out the generator end of the set has been running much cooler than formerly and very satisfactory voltage regulation is obtained.

THE EFFECT OF SOOT ON BOILER EFFICIENCY

Results of Tests Made on Oil-Burning Boilers Before and After the Installation of Soot Blowers

Tests have been made by the superintendent of power, Pacific Gas & Electric Company, on the efficiency of soot-blowing apparatus installed in the two 822-hp., oil-burning Stirling boilers at Station A. The equipment on each boiler consists of six revolving units, one at the top and one at the bottom of each pass. Each unit consists of a 2-in. pipe extending the entire width of the boiler, with special Venturi nozzles placed between the lines of tubes. The pipe is revolved by means of a chain wheel on the boiler side, thus blowing the steam between the tubes. When blowing tubes the path of the furnace gases is followed and the dampers opened wide to allow the soot to be carried out. As shown in the following test results, the temperature of the gases in the stack was decreased 69.25 deg. Fahr. (13.05 per cent) and the temperature of the superheated steam increased 3 deg. (0.6 per cent) by cleaning the tubes. Calling the efficiency of the boilers 70 per cent, this means a saving in fuel of 3.9 per cent due to dusting.

	Before Using Soot Blowers	After Operating Soot Blowers
Load meter	4.075	4.175
Per cent rating	101.88 per cent	104.38 per cent.
Steam pressure	199.5 lb.	200.75 lb.
Superheated steam	499.5 deg. Fahr.	502.5 deg. Fahr.
Stack temperature	553 deg. Fahr.	483.75 deg. Fahr.

The soot that accumulated on the tubes of the oil-burning boiler was a sticky, gummy substance which clung with great tenacity to the tubes. The soot blower used was made by the Diamond Power Specialty Company of Detroit.

USING TRANSFORMERS WITH DIFFERENT CHARACTERISTICS

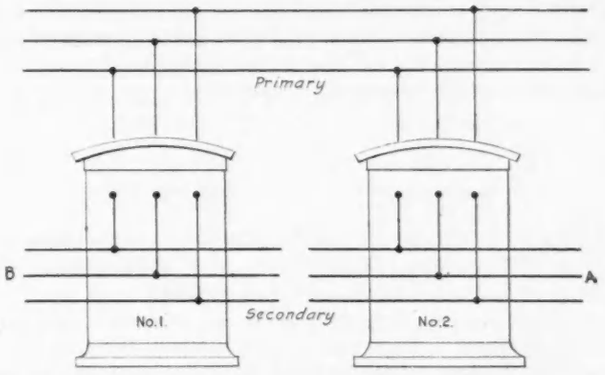
Proper Sharing of Load Insured by Separating Secondaries and Operating One Transformer with Reduced Ratio

BY E. C. PARHAM

The accompanying diagram shows the connections of two three-phase transformers tapped to the same high-tension primaries. By means of links located on the covers but not shown in the diagram, the secondaries can be connected for 115-volt or for 230-volt operation. One of the transformers shown, connected for 115 volts, was formerly used to supply the lighting service for a large mill yard. At that time it was connected to *A* and to *B* which represent service lines to opposite ends of the yard. Later it was necessary to install another transformer to take care of an increased load, one unit being connected to *A* and the other to *B*. Under this condition No. 1 carried more load than No. 2, although neither was fully loaded. Finally, however, No. 1 became so much overloaded that it was necessary to relieve it. Parallel operation was tried but the two units had such different characteristics that they failed to proportionately divide the total load. The condition

could have been improved by the installing of external reactances but the situation was further complicated by the excessive drop and the expense of installing more copper.

As relief was urgent, the operator replaced all of the 115-volt lamps of section *B* with 230-volt lamps and reconnected transformer No. 1 for 230-volt operation. The



TWO DISSIMILAR TRANSFORMERS USED FOR LIGHTING SERVICE

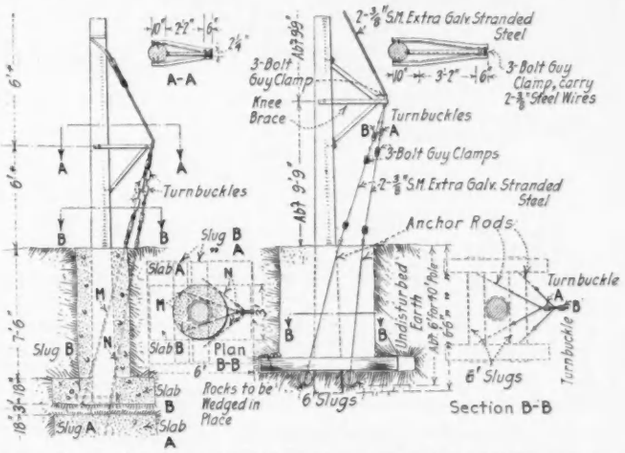
doubling of the voltage halved the current for the given load, halved the line drop for the given current, quartered the energy losses at all loads and solved the problem in a manner that was unobjectionable excepting that it was necessary to use lamps of two voltage ratings. As the 115-volt service was at one end of the yard, and the 230-volt service at the other end, there was little probability of applying low voltage lamps to the higher voltage lines.

GUYING POLES IN LIMITED SPACE

How Difficulties Were Overcome Where It Was Impossible to Secure Guying Rights on the Adjoining Land

BY H. B. SWEENEY

Where space for side guying poles in the usual manner is limited or not available, one of the large transmission companies of Pennsylvania employs the construction indicated in the accompanying drawings. A specific case which came to the writer's attention was



FIGS. 1 AND 2—POLES EQUIPPED FOR GUYING IN LIMITED SPACE

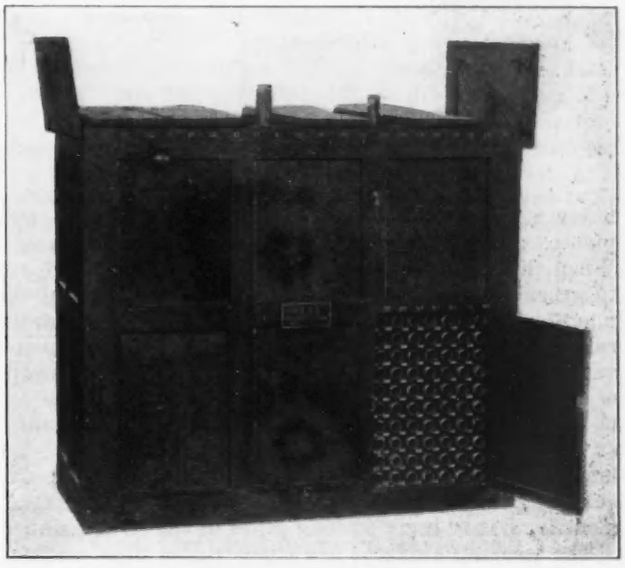
the guying of a pole at a sharp angle in the line where it was impossible to buy guy rights. A guy that might be called a combination knee-brace and truss guy was used. Fig. 1 shows a 45-ft. pole provided with such a guy. The knee is attached approximately midway between the ground and where the guy wires are fastened to the pole. With this construction two double guys are used. One set, *M*, is anchored to slug *B*, which is embedded in the same concrete slab as the pole, and is simply a brace to keep the pole from bending. The other double guy, *N*, serves the purpose of a side guy since it is anchored to the slug *A*, which is embedded in a slab *A* entirely independent of the pole.

Another case which came to the writer's attention was where the side guys on an angle pole had to be removed from the adjoining property. Since the line was an important high-tension circuit, service could not be interrupted, so the pole was temporarily guyed and trenches were dug to receive the slugs shown in the view *B-B* of Fig. 2. The slugs with their attached anchor rods were then securely buried. After guys had been hooked between the knee-brace and the anchor rods and drawn up taut by means of turnbuckles, as shown in the illustration, the temporary guys were removed.

FILING CABINET FOR BLUEPRINTS

Ready Reference Made Possible by Indexed Tubular Compartments in Which Prints Can Be Stored Compactly

Blue prints or maps may be easily filed in the 2-in. pasteboard tubes which are removable from the filing magazine shown in the accompanying illustration. These tubes slip into the fixed compartments which are



COMPACT, LARGE-CAPACITY MAGAZINE FOR PRINTS AND MAPS

arranged in twenty rows with ten in each row. Thirteen rows are 42 in. long and seven rows 18 in. long. In one of the lower corners are seven rows of horizontal tubes 24 in. long. Each fixed tube is numbered and the removable tubes are numbered to correspond. Numbers are also placed on the case opposite each row. With six maps in each tube, the magazine holds 1620 maps. The cost is said to be less than with drawer files, the space occupied a little over half as much, and the prints are not so liable to be torn.

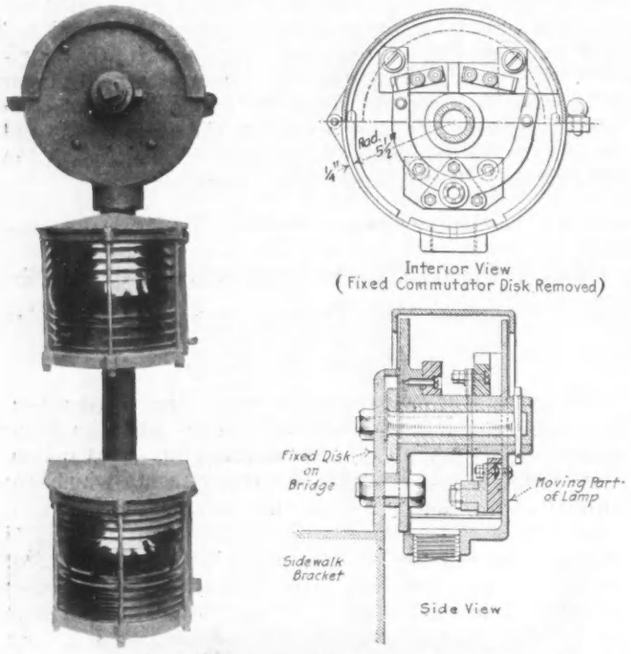
An indexed book is used in conjunction with the file to list the contents according to their numbers. This saves time ordinarily lost in reading titles. The maps are numbered on the back of all four corners, so that refiling is easy.

This magazine was made under the direction of and is patented by E. C. Deal, vice-president and general manager of the North Carolina Public Service Company, Greensboro, N. C.

LAMP FOR BRIDGE WARNING

Construction and Operation of Two-Color Channel-Light Lamp for Indicating Open or Closed Position of Drawbridge

After experimenting with mercury contacts and pendulum pipes swinging back of colored glass, F. H. Avery, engineer in charge of bridge repairs, Chicago, Ill., designed a drawbridge channel light like the one shown herewith. It consists of two lamps hung on a pipe pivoted at its upper end to the end of the drawbridge. When the draw is raised the light is changed from red to green by a switch located at the pivoted end of the pipe. The switch contains no springs, being operated solely by gravity. As the span rises, the lamps remain vertical, pushing the jaw of the switch around by means of a cam passing through the bridge. The lamps can be rotated on the pipe in case a bridge crosses a channel at an angle. A line is attached to the bottom of the lamp and to the bridge hand rail, so that the lamp can be swung through 180 deg. Wherever possible the abutment lamps are hung on long pipes in the same manner.



LEFT—EXTERIOR VIEW OF CHANNEL LIGHT; RIGHT—INTERIOR VIEW—CHANNEL LIGHT DETAILS

The wearing surfaces are oiled from a pipe reaching from above the top of the casting covering the switch mechanism. The electric lamp bulbs are provided with spring sockets, as the filaments will not withstand the constant jar caused by traffic. Telltale lamps installed in a box in the bridgetender's house indicate when the lamps cease to burn.

Thawing Ducts with Hot Water

During the past winter ice formed in an unusual number of duct lines. To remove it several plans have been tried. Heated metal mandrils were used successfully, but slowly. Steam from a small boiler was also employed. The best method appeared to be to direct a stream of warm or hot water into the duct. This method was rapid and had the advantage of carrying away ice in chunks. The difficulty with the plan was one of supplying portable equipment that would deliver the water at temperatures and in quantities that could produce the desired result. One outfit fitted up for this purpose consisted of a small instantaneous gas heater set over a splicer's furnace. The furnace did not give sufficient heat. The gas heater was then suspended on a tripod over a large Wells light operated by kerosene. The flame from this apparatus gave plenty of heat, but was difficult to control. The arrival of warmer weather made further experiments with this apparatus impossible for this winter. It was thought, however, by the central station engineers in charge of the work that if some heat source of a size between that of the splicer's furnace and the Wells light were used the apparatus would be very successful.

INSPECTION SCHEDULE

Arrangements for Insuring Periodic Inspection of Station and Transmission Line Apparatus Used by Ohio Company

In the accompanying illustration is shown one side of an inspection report used by the Ohio Service Company of Coshocton, Ohio. This report covers all inspections that are regularly made, except those which must be reported on some special form. The other side has space for the subject, location, date of inspection, results, and signature. Near the bottom is the heading "Following the above inspection, corrections have been made promptly to apparatus as follows," after which is left four lines for remarks, date and signature. It may be pointed out that lightning arresters are examined just before and during the lightning season.

SCHEDULE OF INSPECTIONS

January and July

First Week, Districts A & C.
Second Week, " B & D.

Switchboard Instruments (except watt-hour meters).
Low Tension Feeder Oil Switches and Relays.
Insulation of Cables in Conduits.
Motor-Generator Sets and Control Devices.

Feb., Apr., June, Aug., Oct., Dec.

Second Week, Districts A & C.
Third Week, " B & D.

High Tension Oil Switches and Relays.
Switching Towers and High Tension Substations.

March and July

Third Week, All Districts.

Electrolytic Arresters and Grounds.
Low Tension Arresters:—Plants and Substations.
Transil Oil. H. T. Transformers, Oil Switches and Lightning Arresters.

March, June, Sept., Dec.

First Week, Districts A & C.
Fourth Week, " B & D.

Switchboard Watt-hour Meters.
Insulation of Generators, H. T. Transformers, Arc and Incandescent Street Lighting Transformers.

Jan., Feb., March, Apr., May, June, July, Aug., Sept., Oct., Nov., Dec.

First & Third Week, All Districts.

Transmission Lines, Poles, Anchors, Guys, Insulators, Conductors, Ground Wire, Trees, Land-Slides, River and Railroad Crossings.
Transmission Telephone Lines, Insulators, Transpositions, Trees and Undergrowth.

Jan., Feb., March, Apr., May, June, July, Aug., Sept., Oct., Nov., Dec.

Second Week, All Districts.

Transmission and Interurban Railway Telephones.

NOTICE: These reports are in triplicate and the first and second copies are to be held by inspector until report is complete. The third copy to be sent to the Manager immediately after inspection is made, and when the fault as found on inspection has been remedied, the first copy is to be sent to the Manager and second copy to Dist. Supt.

When no fault is found the first copy is to be sent to the Manager immediately, the second copy to the Dist. Supt., and the third copy destroyed.

FORM OF INSPECTION REPORT USED BY THE OHIO SERVICE COMPANY

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

RURAL ELECTRIC SERVICE PROFITABLE IN WISCONSIN

Undesirable Ordinarily to Serve Small Individual Consumers from Transmission Lines with Voltages Over 6600

In the report of the committee on rural service before the recent convention of the Wisconsin Electrical Association, F. C. Babson, of Watertown, summarized the findings and opinions of the 1916 committee as follows:

First—The construction of purely rural service lines is not ordinarily warranted unless the saturation of service is such that a reasonable return on the added investment and sale of energy may be shown. Second—Rural service consumers on transmission lines of not over 6600 volts connecting towns or villages, are ordinarily profitable if a suitable minimum charge is made. Third—A suitable minimum charge to cover the higher cost of service for rural consumers should be made, variously estimated at from $2 to $3 per month. Fourth—A low second step in the energy rate should be provided so as to encourage a sufficient use of the service by the farmer to make it practical and attractive.

The total number of companies reporting rural consumers to the committee this year was twenty against eighteen for last year. Five companies which reported seventy rural consumers in 1915 did not report in 1916, but seven companies which did not report rural consumers last year reported 153 consumers this year.

An analysis of Table I, which covers reports from twenty companies, brings to light the following facts: First—In a moderate majority of cases the farmer pays for the extension of primary lines. Second—The cost of transformer installations is carried by the farmer in about one-half the cases reported and by the company in the other half. Third—In a large majority of cases the farmer pays for the extension of the secondary lines. Fourth—In a large majority of cases no refund on the cost of the extensions is made to the farmer where he has contributed to the expense of such extension. Fifth—In a large majority of cases single-phase motors are provided for on rural extensions, and provisions for motors over 5-hp. capacity, single-phase, are exceptional. Sixth—In a majority of cases lines have not been constructed exclusively for rural-service consumers, but have been extended from city lines into well-settled suburban or rural districts. A considerable portion of the rural consumers obtain service from low-voltage transmission lines, where the transmission voltage (up to and including 6600 volts) is stepped down direct to 110 or 220 volts. Seventh—In a majority of cases the rural service is reported to be profitable. It is interesting to note that with an average transformer capacity per consumer of 1.6 kw. and an average connected load per consumer of 2 kw., the income per consumer per annum is $39.

Table II recapitulates the findings in condensed form and compares the findings with those of 1915. The following inference may be reasonably deduced from the data shown: First—There is an apparent slight in-

TABLE I—STATISTICS OF RURAL LIGHT AND POWER SERVICE IN WISCONSIN FOR 1916

Name	Number Consumers	Maximum Dist. from Station, Miles	Farmer Pays for: Primary Line	Transformer	Secondary Line	Meter	Refund	Current: Single Phase	Three Phase	Direct	Maximum Size Single-Phase Motor	Lines for Rural Service Only	Profitable	Transformer Voltage	Lines Step Down Direct	Investment per Kw. Connected Load	Total: Kilowatts Connected Load	Kilowatt-Hours per Year	Transformer Capacity, Kilowatts	Income per Year	Per Consumer: Connected Load Kilowatts	Kilowatt-Hours per Year	Transformer Capacity, Kilowatts	Income per Year	Per Kilowatt—Transformer Cap.: Kilowatt-Hours per Year	Connected Load Kilowatts	Income per Year	Income per Kilowatt-Hour, Cents
Mineral Point	4	18	Y	Y	Y	N	N	Y	..	..	20	N	Y	13,200 33,000	N	..	2.4	2,066	4.0	$229	0.6	516	1.0	$57	516	0.6	$57	11*
Burlington	3	1¼	N	N	Y	N	N	Y	..	..	..	N	..	26,000	N	..	2.4	407	7.0	43	0.8	136	2.3	14	38	0.3	6	11
Edgarton	28	3	Y	Y	Y	N	N	Y	..	..	..	Y	Y	6,600	Y	..	44.0	11,000	45.0	900	1.5	400	1.6	32	244	1.0	20	8
Grand Rapids	3	2	Y	Y	Y	N	N	Y	..	..	3	N	Y	Under 6,600	Y	..	30.0	2,142	....	208	10.0	714	....	69	...	...	...	10
Green Lake	1	6	N	N	N	N	N	Y	..	..	5	N	N	6,600	Y	..	2.0	262	2.0	43	2.0	260	2.0	43	131	1.0	21	16
Ft. Atkinson	13	1½	Y	Y	Y	N	N	Y	Y	..	..	Y	Y	2,200	Y	..*	18.3	7,547	17.5	601	1.4	580	1.3	46	431	1.0	34	8†
Durand	7	4	N	N	Y	N	N	Y	..	..	5	Y	N	6,600	Y	$60	5.0	2,084	14.0	156	0.7	298	2.0	24	148	0.3	12	8
Rice Lake	45	5	N	N	Y	N	N	Y	Y	..	15	Y	N	6,600	Y	..	...	3,871	60.0	608	...	86	1.3	13	60	...	10	16
Glenwood	5	½	N	N	Y	N	N	Y	..	..	..	Y	N	2,300	Y	..	...	.....	7.0	204	...	....	1.4	41	...	...	19	...
Janesville	6	15	?	N	?	N	N	Y	Y	..	7½	N	N	6,600	Y	..	6.7	1,637	6.0	160	1.1	273	1.0	27	273	1.0	27	10
Lake Mills	20	5	Y	Y	Y	N	..	..	Y	..	3	N	Y	6,600	Y	..	60.0	16,000	40.0	600	3.0	800	2.0	30	400	1.5	15	4
Oakfield	4	..	Y	Y	Y	N	Y	Y	Y	..	5	N	Y	6,600	Y	..	...	47,000	....	214	...	11,700	....	53	...	...	...	4‡
Sheboygan	163	7	Y	Y	N	N	Y	Y	..	Y	5	N	Y	13,200	N	..	...	322,022	....	11,152	...	68	....	68	...	...	...	3
Sturgeon Bay	21	2½	Y	Y	Y	Y	N	Y	..	..	3	N	Y	2,300	Y	..	...	.....	32.0	450	...	.....	1.5	21	...	...	14	...
Lake Geneva	14	7	N?	N?	N	N	N	Y	Y	..	5	Y	Y	26,000	N	..	13.8	6,400	42.0	500	0.9	457	3.0	36	152	0.3	12	8
Hudson	4	..	Y	Y	Y	N	N	Y	Y	..	5	N	Y	13,000 13,000 6,000	Y	..	6.5	.....	6.5	200	1.6	....	1.6	50	...	1.0	21	....
Grafton	14	3½	N	N	N	N	N	Y	..	..	10	N	Y	2,300	Y	..	20.0	.....	40.0	....	1.4	....	2.8	...	...	0.5	...	...
Baraboo	2	1½	..	..	..	..	Y	Y	..	..	..	N	..	.....	..	..†	...	256	....	.....	...	128	....	...	...	...	...	...†
Oshkosh	30	5	N	N	N	N	N	Y	..	..	7½	Y	Y	2,300	Y	..‡	45.0	7,044	40.0	724	1.5	243	1.4	25	176	1.1	18	10‖
Beloit	32	2½	Y	N	Y	N	N	Y	..	..	20	N	Y	2,300	Y	..	75.0	17,775	....	1,617	2.3	555	....	50	...	...	...	9
Total reported	419	..	..	..	..	..	..	..	..	..	..	..	..	.....	..	..	331.1	446,493	364.0	18,609	28.8	5,643§	26.2	$699	2,569	9.6	$286	136
Arithmetical average of those reporting	..	..	..	..	..	..	..	..	..	..	..	..	..	.....	..	..	...	.....	.....	.....	2.0	376	1.6	39	233	0.8	20	9

*Less than full year. †Suburban. ‡All power. §Oakfield out. ‖Probably suburban.

crease in the number of companies furnishing rural service and in the number of rural consumers being served. Second—The maximum distance of distribution has increased, indicating a decrease in saturation of service. Third—A large increase in total kilowatt-hour consumption and annual operating revenue. Fourth—A slight decrease in connected load and step-down transformer capacity per consumer, but a noticeable increase in the average revenue per consumer, which would indicate a greater use of the connected load and transformer capacity than in 1915. Fifth—There is an apparent reduction in the kilowatt-hours sold per kilowatt of transformer capacity, which would further indicate a tendency toward less saturation of business.

TABLE II—COMPARATIVE STATISTICS OF LIGHT AND POWER RURAL SERVICE IN WISCONSIN IN 1915 AND 1916*

	1915	1916	Increase, per Cent	Decrease, per Cent
Total companies reporting	.....	40.0	.....	.....
Companies reporting consumers	18.0	20.0	11	.....
Number of consumers	366.0	419.0	14	.....
Average number consumers per company	20.0	21.0	5	.....
Maximum distance from station, miles	6.7	18	.....	.....
Total connected load, kilowatts	471.0	331.0*	.....	30
Kilowatt-hours sold per year	113,166.0	446,493.0	300	.....
Transformer capacity	429.0	376.0†	.....	.....
Total income	$12,234.0	$18,609.0	51	.....
DATA PER CONSUMER—ARITHMETICAL AVERAGE				
Kilowatts connected load	2.3	2.0	.....	13
Kilowatt-hours sold per year	375.0	376.0	.....	.....
Transformer capacity	2.0	1.6	.....	20
Income per year	$35.75	$39.00	9	.....
DATA PER KILOWATT OF TRANSFORMER CAPACITY—ARITHMETICAL AVERAGE				
Kilowatt-hours sold per year	299.0	233.0	.....	22
Kilowatts connected load	1.0	0.8	.....	20
Income per year	$32.6	$20.0	.....	39
Receipts per kilowatt-hour	11 cents	9 cents	.....	18

*Three companies with 168 consumers reporting in 1915 did not report in 1916. Total kilowatts connected load reported by these companies in 1915, 317 kilowatts.
†Transformer capacity not reported by five companies.

It does not seem to be desirable ordinarily to serve small individual consumers from important transmission lines with voltages over 6600, unless the service can be delivered through the medium of local lower-voltage distribution lines.

NEWSPAPER PUBLICITY FOR THE CENTRAL STATION

Local Superintendents of Southern California Utility Receive Prizes for Greatest Number of Column Inches

At the recent annual convention of the Southern Sierras Power Company employees, held in Riverside, Cal., a surprise was announced in the shape of three $10 prizes which went to the local superintendents from towns where the greatest number of column inches had been published in the local newspapers relative to company activities. The towns which the company serves had been divided into three classes: those in which there existed one, two or three newspapers respectively, and the premium was given to the local superintendent who had secured the most publicity in each class.

The town in which headquarters was located was excluded from consideration, of course, but a complete file had been compiled of all press comment that had appeared in the other towns served. In one town in which three papers were published the total amount of space devoted to matters referring to the company during the year amounted to 555 column inches.

Local superintendents are instructed to give a reasonable amount of attention to seeing that the daily papers are provided with such items of interest relating to company business as would readily be classed as news, and to send to headquarters all such clippings.

CENTRAL STATION FINANCING OF MOTOR APPLICATIONS

A Number of Successful Plans Discussed at March Meeting of Ohio New-Business Co-operation Committee Held at Dayton

Through the institution of a trial sale plan, household electric appliances have become more popular and are winning the confidence of consumers of electricity. The success of this plan has led sales managers to ask themselves if a similar plan cannot be worked out to develop a large power load. The discussion of such plans as have been tried received considerable attention at the March meeting of the New-Business Co-operation Committee of the Ohio Electric Light Association when F. I. Woltz, power engineer Union Gas & Electric Company, Cincinnati, read a paper entitled "Financing Motor Installations."

In Cincinnati the forerunners of the trial motor plan were the trial campaigns for gas furnace equipments, gas arcs, and large nitrogen lamp units. The result of these campaigns in placing quickly a large number of appliances, revealed the possibilities of the trial plan.

The method worked out for motor installations, however, was different from the ones before mentioned in that it was not given great publicity and was used as a final argument after the salesman had first tried every possible means and argument to get the business. The customer having been led to the point where he wanted the service, and believed he would profit by it, but felt that the power salesman had perhaps underestimated the operating costs, or that a number of unforeseen conditions would likely arise, the power company assumes the responsibility of proof.

Following is a brief outline of the trial motor proposition which was offered by the Union Gas & Electric Company at Cincinnati.

A letter was written to the prospective customer stating that if he would sign the standard power contract, the company would agree to install all the necessary wiring, motors and starters, make the service connections, and supply the service for three months. During this time the customer would be under no obligations except to pay for energy used according to the specified schedule. If at the end of that time the customer was not satisfied with the service, the wiring and motors would be removed and the plant would be restored to its original condition, and he would be under no further obligations. If, however, the service was as represented and was satisfactory, the customer would pay the agreed amount for the wiring and motors, and service would be continued according to the contract.

Since the installation was to be made by the power company, the customer was requested to furnish the salesman with a list of motor manufacturers and wiring contractors from whom quotations were desired. The power company would then make propositions to these dealers, and those who were willing to co-operate would submit competitive bids direct to the customer. The wiring contractors submitted the same quotation to the power company and to the customer, and payment was made due in three months. The motor manufacturers were required to quote the power company a

resale or dealer's price, which usually was 85 or 90 per cent of the retail or customer's price. The company agreed to make settlement with the manufacturer at the end of the three-month period, and to pay interest from the date the motors were delivered.

The company had the option, however, of returning the motors at the end of the trial period, but was required to pay 10 per cent of the total agreed price. This amount was assumed to cover the expense of testing, cleaning and painting the motors returned.

The plan as above given was used in Cincinnati about two years ago, and Mr. Woltz said it resulted in remarkable success. It was offered only for a short time, because the rapid increase in the use of the central station service became so generally known that it was thought advisable to discontinue the trial proposition. During the three or four months that it was offered twelve large customers were signed and none lost.

"If the company's rates are right," said Mr. Woltz in conclusion, "and the salesman has properly estimated and presented the requirements of his customer, and has satisfied himself as to his customer's integrity, the success of the trial offer is assured. With the necessary modifications to meet local conditions this method of going after new power business will produce gratifying results."

Details of other plans were presented in the discussion by F. B. Steele of Dayton, who stated that a plan similar to that used in Cincinnati has been followed in Dayton. On that basis one installation has been made and a second one closed up a few days ago. Up to the present time the plan has worked perfectly as the only installation has been paid for by the customer. Mr. Steele continued with a description of plans for trial installations in other cities.

For a number of years the Brockton (Mass.) Edison Company has made use of a trial-motor offer which has proved itself a deciding factor in securing many important motor service contracts. The plan is applied only to prospective customers who are already using mechanical drive, for it is not considered necessary to offer a trial motor installation to a new factory. Motors are furnished, however, for new factories on a lease plan originated to care for customers who will use from 1 hp. to 25 hp., and who start business with little capital.

To protect the company against loss, a plate is attached to each motor thus leased, stating that the motor is the company's property. The customer is then required to sign a lease and make a cash payment of 10 per cent of the cost of the motor, after 5 per cent has been added to the list price to cover interest.

Leading up to a trial proposition, the practice is first to interest the man at the head of the company, who, if the plan appeals, is in a position to accept it without referring it to anyone else. With the consent of the owner or manager, an investigation is then made of the power requirements, including methods of manufacture, arrangement of machinery, handling of products, etc. Estimates of wiring cost are made by local contractors, the lowest bidder receiving the job. Failing to gain the prospective customer after a reasonable effort, the trial proposition is offered.

The central station agrees to install at its own expense all electrical equipment required and to allow it to be used for one year. The customer pays in equal monthly installments, as a rental, 15 per cent per annum on the total cost of the installation. The customer at the end of the year is the judge as to the value of the service, and if it is acceptable he agrees to purchase the equipment at cost less 60 per cent of the amount paid as rental.

Since 1906, out of trial propositions with a total connected load of 2500 hp., only one proposition, one of 115 hp., has been lost. The cost to the company for these installations was $42,400, or an average of $16.96 per horsepower, all of which was returned with 6 per cent interest, with the foregoing exception. The average gross yearly income from this 2500 hp. has been $65,200 or $26.08 per horsepower of motor rating.

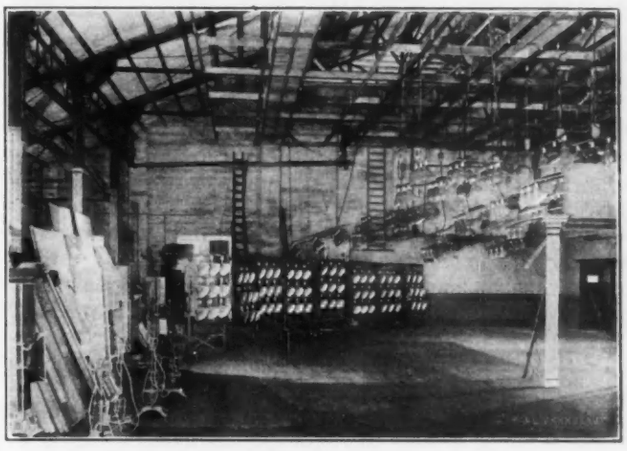
In 1906 the connected motor load of the Brockton company was 892 hp. with a yearly gross income of $15,021, and it is now 7641 hp. with a yearly gross income of $156,071, about 37 per cent having been gained by the trial plan.

The Electric Light & Power Company of Abington & Rockland, another Stone & Webster property, has not yet lost a single installation of trial motors, and its connected power load has increased from 25 hp. in 1906 to 2810 hp. to-day, about 20 per cent of which was secured by the trial proposition.

ELECTRICAL MARKET IN MOVING PICTURE INDUSTRY

Value of Projection Machinery Placed at $11,000,000 —Daily Energy Requirements by Theaters 270,000 Kilowatt-Hours

An estimate of the present status of the moving-picture industry in the United States and Canada places the number of moving-picture houses at 20,000. On this basis, and assuming that these theaters use an average



IN SOUTHERN CALIFORNIA WHERE 80 PERCENT, OF THE PHOTOPLAY OUTPUT OF THE WORLD ORIGINATES ELECTRIC LAMPS WORKING HAND IN HAND WITH THE SUN THROW PHOTO-QUALITY LIGHT FROM THE SIDES

of 30 amp. at 110 volts for projection, and that the average show lasts five hours per day, the requirements would be 270,000 kw.-hr. per day and 50,000 to 75,000 carbons per day.

The value of projection machinery involved, including transformers, motor-generator sets, mercury-arc rectifiers, etc., is placed at $11,000,000. The replacement of worn-out machines calls for ten to twenty new projectors per day. An army of 25,000 to 30,000 operators is required and they handle film valued at a total of $15,000,000. The daily income figured at an average of 8.5 cents per admission from 12,000,000 to 15,000,000 people amounts to $400,000,000 a year.

In southern California, which is one of the main centers of motion-picture production, forty-five producing companies operate studios. Of these twenty have indoor studios where pictures are filmed by electric light. One of the larger of these indoor studios is laid out for the use of 2000 kw. in lighting a structure 100 ft. by 150 ft. in plan.

ADVANCE IN TECHNICAL THEORY AND PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

CURRENT DENSITY

How the Selection of the Current Density Affects the Design and Operation of the Whole Electrolytic Plant—Applications to Copper Refining

THE current density, or amperes per square foot or square meter of active cathode surface, is the factor in an electrolytic process, such as copper refining, upon which above all others the design and operation of the plant depend, as upon it hangs a string of minor factors which must be properly correlated in order to obtain the best return upon the investment. These factors may be classified under cost per pound of cathodes recovered, first cost of plant, and metallurgical purity of product. This subject is discussed in an interesting manner in an article by Lawrence Addicks in *Metallurgical & Chemical Engineering* of March 15.

Aside from commercial considerations there is a limit to the density which can be employed imposed by the temperature of the electrolyte. By far the larger part of the electrical energy called for is converted into heat in overcoming the ohmic resistance of the cells and the temperature of the electrolyte rises until the heat losses offset the C^2R gain.

The electrodes are spaced so closely in the tanks that the equivalent energy to be dissipated is quite large and further at about 150 deg. Fahr. a liquid will begin to steam sufficiently to make a tank room too foggy for comfort or for efficient inspection.

Mr. Addicks discusses at some length the question of electrolytic temperature. The final and really controlling reason for the use of warm electrolyte is the greatly improved metallurgical conditions resulting therefrom. Not only is the cathode smoother and denser, but the conditions at the dissolving surface of the anode are greatly benefited.

The increased temperature brings about a local circulation which assists in removing the dense solution of copper sulphate from the face of the anode and in preventing stratification in the tank. When current is passed through a cold cell without any circulation of the electrolyte, conditions soon become so unbalanced that the electrodes will gas, the voltage show violent fluctuations and the anode slimes be stirred up and carried in suspension, thereby fouling the cathode. When the electrolyte is systematically circulated these bad effects are counteracted, but the rate of circulation which can be employed is limited by the eventful stirring up of the slimes mechanically. There is in turn a current density for this limiting circulation which begins to bring about a return of the undesirable gassing, and for a cold liquor and an impure anode this density is so low as to require an abnormally large plant investment. When the electrolyte is heated this density limit is greatly raised and it was practice even in the very early days to heat the electrolyte somewhat—perhaps to 110 deg. Fahr.—and later this temperature has been gradually increased until 135 deg. Fahr. entering the tanks is not uncommon.

The temperature problem is summed up by Mr. Addicks in the following statements: (1) The temperature of the electrolyte should be carried well up toward the practical limit of 150 deg. Fahr. in order to be able to employ as high a current density as may be desirable from the point of view of cost of operation; (2) unless a very high density permitted by very unusual conditions is employed, heating in the solution well will be required to maintain this temperature; (3) with proper exhaust steam design this heating will be practically free of direct expense.

Power cost is the next subject taken up. Mr. Addicks gives a table which shows that the power cost per pound of copper rises nearly in proportion to the current density employed. On the other hand, the electrical heat dissipated in the tanks simultaneously increases, and this means that less heating steam will be required and this saving will give some credit to be applied against the power cost.

It is thus evident that the cost of producing a kilowatt-hour will have a great deal to do with the question; in fact, it is possible to plot the power cost at various plants against the current density used and obtain quite a smooth curve. Fig. 1 shows this general relation, but individual cases may show exceptions for special reasons. The abscissas give cost of power in cents per kilowatt-hour, and the ordinates give current density in amperes per square foot (1 amp. per square foot = 10.8 amp. per square meter).

The first cost of the refining plant depends in a double manner on the current density. The first cost of plant

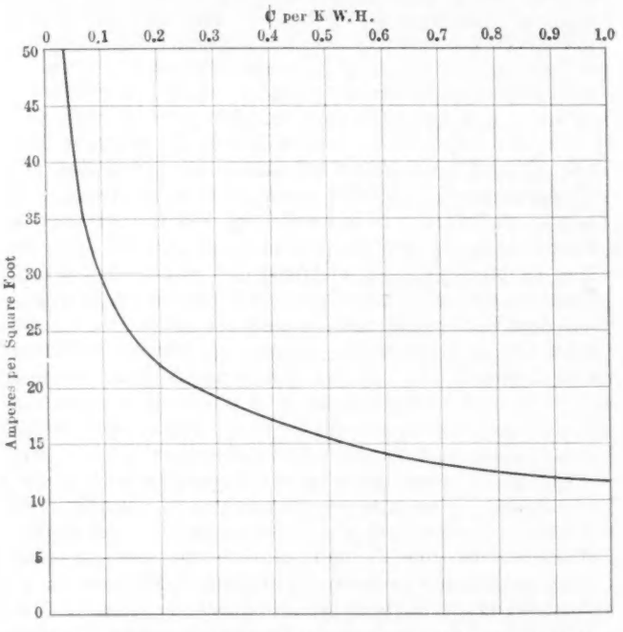


FIG. 1—CURRENT DENSITY VS. POWER COST IN PRACTICE

comprises an investment in tanks and an investment in power plant; the former varies with the output of cathodes per tank day and the latter with the kilowatt demand, both of which depend upon the current density. To show how this works out we extract a few figures from a table compiled by Mr. Addicks. Under certain plant conditions if the current density is 5, 15, 25, 30, or 40 amp. per square foot (54, 161, 269, 323 or 430 amp. per square meter), the total investment per pound

of copper per day will be $3.77, $1.71, $1.54, $1.57, $1.72, respectively.

The main labor items in operating a tank house are for inspection work to maintain current efficiency and for inserting and drawing the electrodes as the copper moves through the process. The higher the current density the more difficult is it to maintain the efficiency on account of the increased number of short-circuits caused by rough deposits on the cathodes.

In case of building a new refinery, it may be that there is a choice between five locations where the prob-

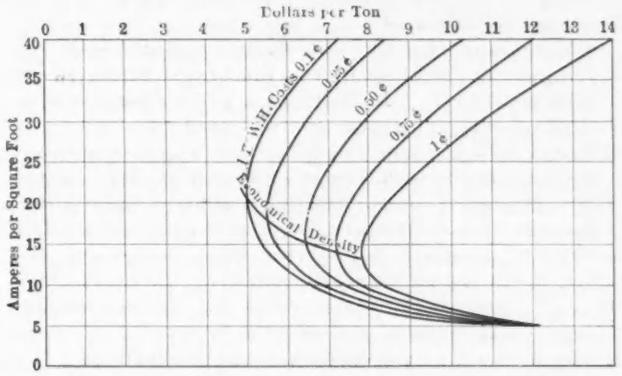

Dollars per Ton
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14
40 35 30 25 20 15 10 5 0
Amperes per Square Foot
1 K.W.H. Costs 0.1 ¢
0.25 ¢
0.50 ¢
0.75 ¢
1 ¢
Economical Density

FIG. 2—CURRENT DENSITY VS. VARIATION IN TOTAL OPERATING COSTS

able power cost is estimated at 0.1 cent, 0.25 cent, 0.5 cent, 0.75 cent, and 1 cent per kilowatt-hour respectively, and other conditions are equal. In that case it will be necessary to calculate for each case the total cost of operation (including interest and depreciation) for varying current densities and plot the results, where a diagram like Fig. 2 will be obtained. If the minimum power costs from the different curves are taken from this diagram and plotted against current density, the same general relation is found which is shown in Fig. 1.

Generators, Motors and Transformers

Parallel Operation of Static Transformers.—J. LINDLEY THOMPSON.—The first part of an illustrated article in which the author deals first with the aspects of voltage ratio, impedance and polarity, as affecting the operation of single-phase transformers in parallel. Comparative tables are given showing the effect on loading of varying ratios of resistance and reactance, and also of unequal impedance. Formulas are given to determine the transformer current values and phase angles under these conditions. Polyphase transformers are then treated in a similar manner, but with the inclusion of a study of phase rotation. The "phasing out" of three-phase transformers is described, tables and diagrams being given which show possible voltage measurements obtainable. Results of paralleling dissimilar groups of transformers are described, and in conclusion the effects of position of junctions to busbars or main cables, temperature and power factor are discussed.—London *Electrician*, Feb. 9, 1917.

Polyphase Induction Motors with Unbalanced Secondaries.—A. A. GAZDA.—A paper read at the New York meeting of the American Institute of Electrical Engineers, in which continuous operation of the wound-rotor induction motor, when the external resistances in the secondary phase are not equal, is shown to be feasible. The effect upon power factor and heating is discussed. Curves showing the performance of polyphase motors with single-phase secondary are presented. The practical advantages of using unbalanced secondary connections are pointed out. The principal practical conclusions of the author are as follows: With the proper design of resistor steps, it is safe practise to operate polyphase induction motors at full-load torque, with unbalanced secondary resistance. Under these conditions, the power factor will be slightly reduced, but the increased copper loss will be amply compensated for by the better ventilation of the motor at the higher speeds. A limited range of motors which have a low percentage of magnetizing current, may be operated under full-load torque at half speed, with single-phase secondary, while practically any motor may be operated under these conditions when connected to a variable torque load, such as blowers, centrifugal pumps, etc. This method permits a great simplification of control apparatus. Control schemes, including single-pole resistance switches, may be used, which will result in fewer parts to maintain, less control wiring and smaller-size controller. The amount of resistance may be reduced, and floor space saved.—*Proceedings*, Amer. Inst. Elec. Engrs., February, 1917.

Calculating the Performance of Polyphase Induction Motors.—LUTHER H. JAMES.—An article illustrated by diagrams in which the author gives a new method for calculating the performance of a motor to within as close a degree of accuracy as may be obtained by the use of the triangle and compass, but without resorting to unnecessary refinements. The method is illustrated by numerical examples.—*Elec. Journal*, March, 1917.

Induction Motor Characteristics.—L. W. SMITH.—An article discussing and illustrating by diagrams the effect of variations of voltage or of variations of frequency on induction motor characteristics.—*Elec. Journal*, March, 1917.

Balancers for Three-Wire Continuous-Current Systems.—THOMAS CARTER.—In a continuation of his long illustrated mathematical article on balancers, the author discusses the effect of compounding on load in the armatures of rotary balancers, the types of field windings for rotary balancers, and the design of compound-wound fields for rotary balancers.—London *Electrician*, Feb. 16, 1917.

Electrochemistry and Batteries

Lead Storage Battery.—CH. FERY.—The author reviews the different theories of the lead accumulator and describes an investigation of his own from which he concludes that at the end of a charge the negative plate is spongy lead and the positive plants not PbO_2, but Pb_2O_5, and that during discharge the former is changed to lead sulphate and the latter not to lead sulphate, but to PbO_2 (with formation of water).—*Revue Gen. de l'Elec.*, Jan. 6, 1917.

Units, Measurements and Instruments

Direct-Current Meters.—ZIEGENBERG.—A discussion of various recent improvements in the design of direct-current meters. The comparative advantages of disk armatures and drum armatures as well as various constructive details are dealt with.—*Elek. Zeit.*, July 6, 1916; an illustrated French translation in abstract, *Rev. Gen. de l'Elec.*, Feb. 10, 1917.

Magnetic Braking Couples.—G. VALLAURI.—In a certain type of maximum-demand meter a magnetic brake formed of a nickel cylinder placed in a constant magnetic field is used. It is generally admitted that the couple required to start the meter is larger than the braking couple when the meter is in motion; so that the magnetic couple would be analogous to a friction couple. The author demonstrates theoretically that this assumption is not correct and that the magnetic couple must be the same both at starting and during rotation. As a matter of fact, the magnetic couple is due to the hysteresis, and its value is given by the

formula $HI \sin \varepsilon$, where H is the field intensity, I the intensity of magnetization, and ε the angle between these vectors, which angle cannot be larger than a certain value ε_0, specific to the magnetic substance employed. When a small mechanical couple is applied to the cylinder this turns by an angle Θ and the vector I by an angle ε, so that $HI \sin \varepsilon$ is equal to the mechanical couple. The angle Θ is always larger than ε. The static equilibrium is only possible if the mechanical couple is not larger than $HI \sin \varepsilon_0$; beyond this value the cylinder begins to turn. The small number of experiments available have shown that the value of $HI \sin \varepsilon_0$, is independent of the speed. The reason why the starting couple in the meter referred to is larger than the motion couple must be found, therefore, according to the author, principally in the mechanical friction between the axis and its supports, rendered still larger than usual by the practically unavoidable lateral magnetic attraction between the cylinder and the permanent magnet forming the field. Subsidiary reasons can be errors of centering of the cylinder, lack of homogeneity in its material, and its strong residual magnetization. In these cases the starting couple must be larger than the maximum value of the magnetic couple, while during the rotation, owing to the mechanical inertia of the rotating parts, the mechanical couple need be equal only to the mean value of the magnetic couple.—*Elettrotecnica*, Oct. 25, 1916; abstracted in *Science Abstracts*, Section B, Jan. 31, 1917.

Telegraphy, Telephony and Signals

Effect of Water Vapor in the Atmosphere on the Propagation of Electromagnetic Waves.—F. Schwers.—An abstract of a British Physical Society paper. The author discusses the probable influence of moisture in the atmosphere on the refraction of electromagnetic waves round the earth's surface. The conclusion of Kiebitz that the presence of moisture does not affect the dielectric constant by more than 10 per cent is shown to be erroneous, being based on the assumption that the Clausius-Mossoti formula holds when passing from the liquid to the gaseous state. Examples are quoted to show that this law fails in many cases, especially where the dielectric constant is high in the liquid state. In the absence of more accurate data for ordinary temperatures, the author prefers to assume a value for the dielectric constant of water vapor obtained by extrapolating the results obtained by Baedeker for higher temperatures. The extrapolated value is almost certainly too low. From this result, and the average conditions of the atmosphere over the ocean with regard to temperature gradient, etc., deduced from meteorological data, it is shown that the lowest layers of the atmosphere (1000 to 1500 m. approximately in depth) refract electromagnetic waves toward the earth, so that the greater part of the space waves will reach the receiver, contrary to the conclusion of Kiebitz.—London *Electrician*, Feb. 16, 1917.

Installations, Systems and Appliances

Frequency Changers.—R. Townsend.—A paper read before the (British) Institution of Electrical Engineers in which the author first deals with induction frequency changers and then with synchronous frequency changers. From the point of view of cost, efficiency, overload capacity, reliability, maintenance and floor space, both types are practically on an equality (assuming the same synchronous speed with each type). The type to be adopted must, therefore, be determined by the other characteristics of the machines. The difficulty and troubles experienced in connection with the operation of synchronous frequency changers are not as real in practice as one would at first expect. If either the motors or the generators are fitted with rotatable stators, the synchronizing and load distribution is as simple, or even more simple, than with induction frequency changers. If the machines have non-rotatable stators, the difficulty of synchronizing depends to a great extent on the ratio of frequency conversion. In any case, the operation of "slipping poles" by reversing the motor excitation is easily carried out, and will quickly bring the generators into the correct phase relation for paralleling. Taking all the points into consideration, the advantages of the synchronous frequency changer are sufficient to justify its adoption in the majority of cases.—London *Elec. Rev.*, Feb. 23, 1917.

Automatic Methods of Accelerating Motors.—H. D. James.—A continuation of the illustrated serial on industrial controllers. In starting a motor, resistance is inserted in the armature and is gradually short-circuited. For doing this automatically four methods are in use, namely the counter-emf. method, the series relay method, the series lock-out switch method, and the time-element method. These are discussed in succession. The counter-emf. method is used for small controllers, although it can be successfully employed for quite large units. The series relay method is the most expensive, but very satisfactory, and should be used for heavy service, where the load varies through wide limits. The series lock-out switch is satisfactory for starting service where the acceleration is always under load. The last resistance switch is often provided with a holding coil to keep it from drooping out on light loads. Sometimes the last switch is operated by the counter emf. of the motor and the preceding switches on the lockout principle. The time element device is the most satisfactory to use where the voltage varies over wide limits, particularly where rapid starting is not necessary.—*Elec. Journ.*, March, 1917.

Wires, Wiring and Conduits

Cable Junction Boxes.—S. G.—An article illustrated by a series of diagrams on the design and construction of cable junction boxes discussing sweating sockets, design of fittings, disconnecting links, spreaders and separators, wood brushes, compound pockets, lifting handles, coating of boxes, pavement frames and covers, lead sleeve joints, lid joints, and the filling compound.—London *Elec. Rev.*, Jan. 12 and 19, 1917.

U. S. Safety Rules.—An editorial on the Safety Rules on Electrical Work issued by the U. S. Bureau of Standards. Some doubt is expressed whether such voluminous regulations will secure the end for which they are issued, but it is emphasized that the code is the outcome of a great deal of work. "Although certain criticisms have been made, it must be acknowledged that the code is the considered opinion of a large number of experienced engineers in the United States." It is thought that in some respects the rules have gone rather too far in detail.—London *Electrician*, Feb. 9, 1917.

Generation, Transmission and Distribution

Flywheel Load Equalizers.—An illustrated article on the operation of flywheel load equalizers such as are used for electric winders and rolling mills and also for coal hoists and ore-handling plants. After an explanation of the principle of the flywheel load equalizer an algebraic and a graphical method of determining the weight of the flywheel are given and illustrated by examples. After some notes on windage losses of flywheels and mechanical details, three systems are described and discussed (the simple flywheel generator set, the motor-generator flywheel set, and the converter system) and the differences between the three systems are discussed.—London *Electrician*, Feb. 16, 1917.

Book Reviews

UNDERGROUND TRANSMISSION AND DISTRIBUTION FOR ELECTRIC LIGHT AND POWER. By E. B. Meyer. New York: McGraw-Hill Book Company, Inc. 312 pages. 156 illustrations. Price, $3.

For the specialist and for central station engineers who are responsible for the installation and maintenance of underground distribution systems, this book will be found of every-day interest and value. Through his extensive experience and practical knowledge of the various requirements of underground systems as an engineer of the Public Service Electric Company of New Jersey Mr. Meyer is especially well qualified to write on this subject. The information presented reflects a practical viewpoint so that besides being a treatise on underground work, it is in every way complete and suitable as a practical engineer's guide and reference on the latest and best practice as well as on systems and equipment. With the exception of the work by Gear and Williams on central station distribution systems, there is no book which compares with it for wealth of detail. These two works are in no way rivals, for the field covered by Mr. Meyer forms only a small part of the scope of Gear's and Williams' book. They should therefore be considered as companions and both have a place in the library of the central station engineer who has to do with any part of distribution work. The following chapter headings of the book under consideration indicate in a fair way the character of the material presented: Historical review; preliminary survey; conduit and manhole construction; methods of distribution; cables; installation of cables; testing of cables; distribution systems and auxiliary equipment; electrolysis; operation and maintenance.

HANDBOOK OF MACHINE SHOP ELECTRICITY. By C. E. Clewell. New York: McGraw-Hill Book Company, Inc. 462 pages. Illustrated. Price, $3.

The author of this book has compiled from many sources including the latest handbooks, a great deal of practical data and information on the selection, installation, and operation of the electrical equipment that is required in a machine shop. While at first thought it might seem that existing handbooks on electrical engineering would be preferable to a condensed volume dealing with a special field of electrical applications, an inspection of the volume under discussion shows there is considerable merit in the plan of the author. Just the information pertaining to machine shop practice is presented and the user is not required to select from a mass of general information that data and information which seems to him to fulfill his conditions. This work has all been done by the author and where it lacks in completeness it makes up in its definiteness and practical value. It is plainly a practical man's handbook written in a simple understandable way with little technical theory except where it was essential to explain the operation of electrical machines and devices. The book is divided into ten sections devoted to the following topics: 1—Abbreviations, terminology and units. 2—Circuits. 3—Costs. 4—Communication and distant control. 5—Current supply, generators, and transformers. 6—Electrochemical, soldering and welding applications. 7—Heating and magnetic apparatus. 8—Lamps and shop lighting. 9—Measuring instruments and measurements. 10—Motors and applications.

The section on costs is a valuable feature of the book, a feature which is too often overlooked in handbooks and published articles on the excuse that costs may be misleading or possess value for a limited time only. While the author takes this attitude through an introductory statement in which he says, "Costs in themselves based on averages must be interpretated with caution and it is suggested that the values given be employed only for preliminary estimates," he is rather liberal in his selection of prices and covers a range that enables the operator who uses, rather than buys materials, to get an idea of costs certainly much closer than from catalogs, with list prices, on which discounts of 50 to 60 are possible. Since the catalog is the most familiar and most common form of information on machines found in the hands of operators it is certain that carefully interpretated costs in a handbook can not work serious harm to the user or the manufacturer while on the other hand when checked up on final estimates by up-to-the-minute prices such data are most useful and helpful information. The costs in this handbook are of just this nature and the author is to be complimented on the prominence he has given this matter. This handbook merits the careful consideration of all practical workers, electricians, mill and shop master-mechanics, etc.

PRIMARY BATTERIES: THEIR THEORY, CONSTRUCTION AND USE. By W. R. Cooper. London: "The Electrician" Printing & Publishing Company. 458 pages. 215 illustrations. Price 12s. 6d.

This is a new and enlarged edition of a very practical textbook which first made its appearance in 1901, and which has received much new material since that date. The author has been fortunate in selecting a title sufficiently restrictive to enable him to discriminate against all secondary and storage cells, thus keeping the book on a consistent basis. On the other hand, by including selenium cells, which owe their emf. to incident radiation energy, the author comes up to the narrow edge of security in his definitions and discrimination. It is so seldom, however, that we find selenium cells suitably treated in electrical literature that we owe the author thanks for nearly having trespassed beyond his own delimitations.

The book is divided into thirteen chapters on the following subjects: Historical; The simple voltaic element; Local action; Theory of the voltaic cell; Non-chemical cells; Testing cells; One-fluid cells; Two-fluid cells; Dry cells, Standard cells; Selenium cells; Carbon-consuming cells.

The chapter on standard cells is particularly attractive. The treatment is clear and practical. The electrochemical theory is explained in simple terms with the aid of mathematical expressions.

Books Received

AWAKENING OF BUSINESS. By Edward N. Hurley. Published by Doubleday, Page & Company, Garden City, N. Y., for the Associated Advertising Clubs of the World. 240 pages. Price, $2.

MANUFACTURE OF ARTILLERY AMMUNITION. By Members of the Editorial Staff of the *American Machinist*. L. P. Alford, Editor-in-Chief. New York: McGraw-Hill Book Company, Inc. 766 pages. 669 illustrations. Price, $6.

INTERIOR WIRING AND SYSTEMS FOR ELECTRIC LIGHT AND POWER SERVICE. By Arthur L. Cook. New York: John Wiley & Sons, Inc. 416 pages. 248 illustrations. Price, $2.

ELECTRIC AND MAGNETIC MEASUREMENTS. By Charles Marquis Smith. New York: The Macmillan Company. 374 pages. 171 illustrations. Price, $2.40.

CALCULUS. By Herman W. March and Henry C. Wolff. New York: McGraw-Hill Book Company, Inc. 360 pages. 125 illustrations. Price, $2.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

SUPREME COURT DECISION AGAINST UTAH COMPANY

Highest Tribunal Holds That Congressional Right to Control Occupancy and Use of Public Lands Is Controlling Over State Enactments— Mr. Mitchell's View

The United States Supreme Court rendered on March 19 its opinion in the water-power case of the Utah Power & Light Company and others. Justice Van Devanter delivered the opinion, which is in part as follows:

"Not only does the Constitution commit to Congress the power 'to dispose of and make all needful rules and regulations respecting' the lands of the United States, but the settled course of legislation, congressional and state, and repeated decisions of this court have gone upon the theory that the power of Congress is exclusive and that only through its exercise in some form can rights in lands belonging to the United States be acquired.

"True, for many purposes a state has civil and criminal jurisdiction over lands within its limits belonging to the United States, but this jurisdiction does not extend to any matter that is not consistent with full power in the United States to protect its lands, to control their use and to prescribe in what manner others may acquire rights in them.

National Supremacy Sustained

"From the earliest times, Congress by its legislation, applicable alike in the states and territories, has regulated in many particulars the use by others of the lands of the United States, has prohibited and made punishable various acts calculated to be injurious to them or to prevent their use in the way intended, and has provided for and controlled the acquisition of rights of way over them for highways, railroads, canals, ditches, telegraph lines and the like. The states and the public have almost uniformly accepted this legislation as controlling, and in the instances where it has been questioned in this court its validity has been upheld and its supremacy over state enactments sustained.

"And so we are of opinion that the inclusion within a state of lands of the United States does not take from Congress the power to control their occupancy and use to protect them from trespass and injury and to prescribe the conditions upon which others may obtain rights in them, even though this may involve the exercise in some measure of what commonly is known as the police power.

Congress Intended Some Regulations

"By their answers the defendants assert that some of the administrative regulations promulgated under the act of Feb. 15, 1901, go beyond what is appropriate for the protection of the interest of the United States and are unconstitutional, unauthorized and unreasonable. That Congress intends there shall be some administrative regulations on the subject is plainly shown in the act, and that its discretion in the matter is not narrowly confined is shown by our decisions.

"If any of the regulations go beyond what Congress can authorize or beyond what it has authorized, those regulations are void and may be disregarded, but not so of such as are thought merely to be illiberal, inequitable or not conducive to the best results. In the nature of things it can hardly be that all are invalid, and this was conceded in argument."

Through a mistaken view the defendants "are occupying and using reserved lands of the United States without its permission and contrary to its laws. Not until they seek a license or permit under the act and conform or appropriately offer to conform to all lawful regulations thereunder will they be in a position to complain that some of the regulations are invalid. As we interpret the decrees below, they enjoin the defendants from occupying and using the lands of the United States until, and only until, they acquire rights to do so by complying with some applicable statute and the lawful regulations. Of course we do not imply that any of the regulations are invalid but leave that question open.

Compensation Measured by Reasonable Value

"As the defendants have been occupying and using reserved lands of the United States without its permission and contrary to its laws, we think it is entitled to have appropriate compensation therefor included in the decree. The compensation should be measured by the reasonable value of the occupancy and use, considering its extent and duration, and not by the scale of charges named in the regulations as prayed in the bill. However much this scale of charges may bind one whose occupancy and use are under a license or permit granted under the statute, it can not be taken as controlling what may be recovered from an occupant and user who has not accepted or assented to the regulations.

"It follows that the decrees are right and must be affirmed, save as they deny the government's right to compensation for the occupancy and use in the past, and in that respect they must be reversed."

Statement of Sidney Z. Mitchell

Sidney Z. Mitchell, president of the Electric Bond & Share Company, of which the Utah Securities Corporation, which controls the Utah Power & Light Company, is a subsidiary, said that the case was not important as affecting the particular matter in controversy between the Utah Power & Light Company and the government because the water power involved at Battle Creek, Utah, is less than 3 per cent of the total capacity of the Utah company. The question was not whether the company should continue to operate the site or move off, but whether the company had the right to use the site under the act of Congress passed in 1866, which the government claimed had by inference been repealed, or if the company should continue to operate the site under lease from the government, paying a nominal rental.

The particular issue, Mr. Mitchell said, was whether the act of 1866 had been repealed, thus making legal the policy adopted by the Agriculture and Interior departments in regard to leasing the public lands generally in Western states for water-power purposes. The actual money involved is trivial in amount, but the principle concerned is of tremendous importance to all states having public lands, the development of which has been greatly retarded by interpretation of federal laws.

SUPPORT THE FRANCHISE PLAN FOR DALLAS, TEX.

J. F. Strickland and C. W. Hobson Stand by the Offer Upon Which Voters Are to Act on April 3, Notwithstanding Impending War Conditions

J. F. Strickland and C. W. Hobson have issued a statement in reply to the announcement of Mayor Lindsley of Dallas, Tex., that he will not vote for the franchises which are to be submitted to citizens on April 3. Messrs. Strickland and Hobson say in part:

"As to valuation, we say that our agreement with the Mayor and entire Board of Commissioners was that if the valuation was approved by the postal card vote the question was then settled as between them and us.

"As to the rate of return, we say that our last concession of a 7 per cent base rate of return on the lighting properties, as well as on the railway properties, was made on the statement of the Mayor that he would support the franchises in that respect.

"As to the franchises being perpetual, we say that the point as presented by the Mayor is entirely new. He says it is a perpetuity because the valuation is too high and the terms of purchase burdensome. As to the valuation, we would have obtained our option at a lower price if we could. The valuation, in our opinion, is fair. The terms of purchase are also, in our opinion, fair.

"If our commitments to reorganize and refinance the lighting and traction properties of this city had been made only to the Mayor, we should feel, under existing circumstances, that our commitments with propriety might be withdrawn. The burden of financing these properties with impending war conditions is much greater than it was at the time the commitments were made. We feel, however, that our good faith is pledged to those members of the Board of Commissioners who have announced their intention of supporting the franchises on a referendum and to the people of Dallas to go forward with the enterprise of localizing the management of these properties, and we shall not withdraw unless the people of Dallas indicate their disapproval of the franchises."

HYDROELECTRIC PROGRESS AND PLANS IN CALIFORNIA

Pacific Gas & Electric Company Puts 10,000-Kw. Plant in Service and Great Western Power Company Completes Arrangements for a Larger Development

The new 10,000-hp. generating station of the Pacific Gas & Electric Company, known as the Wise plant, was put in service on March 4. This plant is a unit of the Drum system, which includes four successive sites developing all the available head along the same watercourse. Three of the plants in this chain have already been built. The farthermost is just within the 150-mile circle centering at San Francisco. A general description of the two latest additions to this series appeared in the ELECTRICAL WORLD for Jan. 15, 1916, page 171.

Simultaneously with the addition of this plant to the system comes word that the Great Western Power Company has been making surveys looking to the construction in the near future of a new plant on the North Fork of the Feather River about 3 miles from Oroville. This plant will be about 9 miles due south of the Big Bend; it will be designed for about the same minimum stream flow and will utilize it under a 300-ft. head. There will be a 12-mile canal from the tailrace of the Big Bend plant to the forebay of the new plant.

In addition to this site the company controls three others on the North Fork of the Feather River.

The reason assigned for selecting the site near Oroville for the increase of capacity now contemplated is that this plant will be within about ¼ mile of the 100,000-volt line which now delivers energy from the Big Bend plant. By the development of this site the additional power can be put into the transmission system with the least investment in copper, a most important consideration.

COLUMBUS CO-OPERATION A NOTABLE DEVELOPMENT

Dinner Given by Electrical Contractors and Dealers' Association to the Twenty-Six New-Business Representatives of the Central Station Company

Members of the new-business department of the Columbus (Ohio) Railway, Power & Light Company were entertained on the night of March 14 at a banquet and theater party given by the Columbus Electrical Contractors' & Dealers' Association. In addition to the twenty-six representatives of the company, eighty-five contractors and dealers were present.

SUCCESSFUL WIRING OF OLD HOUSES

This association was formed in March, 1916, for the purpose of co-operating to the fullest extent possible in the electrical industry in Columbus. Since that time the Columbus Railway, Power & Light Company alone has taken 829 contracts for wiring already-built houses. All of this work is turned over to the contractors under a plan whereby the company pays the contractors in full at the completion of the work and allows the new customer to pay the amount in ten monthly payments with his light bill.

The contractors have wired over 400 already-built houses. Much progress has also been made in other branches of the industry as indicated by the improvement made in show-window lighting, the thousands of electrical applances sold, the large number of electrical signs placed in operation and the wonderful increase in the use of electricity for power.

The meeting was unique in the fact that the contractors' association acted as host. A fine spirit of co-operation is in evidence between the association and the central station and both sides have pledged their loyal support to the advancement of the electrical industry in Columbus and vicinity.

LARGE GENERATING STATION DEVELOPMENT

Harold W. Clapp, general superintendent of the Columbus company, made a short talk at the banquet. He referred to the new power station now under construction, located 8 miles southeast of the city. The initial installation will consist of a 15,000-kw. turbine unit with all necessary auxiliaries. This turbine will be placed in operation in the fall of this year. The energy from this installation will be distributed over the system through necessary transmission and tie lines between stations. A 10,000-kw. turbine unit is now on order for delivery in April, 1918. This will be in service in the early summer of 1918. Another 15,000-kw. turbine will be installed in 1919, making the ultimate capacity of the station 40,000 kw. This is an indication of the development possible in the territory, and the contractors are working hand in hand with the company for proper development and for their mutual benefit.

O. L. Bowers is president of the Contractors' & Dealers' Association and Howard Thompson is secretary. C. A. Entrekin, contractor, made a successful toastmaster of the evening.

DELAY IN THE INDIANA ELECTRIC RANGE CAMPAIGN

Committee Has Not Yet Secured the Fund Which It Requires, but the Pledges Received Will Probably Be Held and Additions Made When Possible

The new-business committee of the Indiana Electric Light Association, which made an attempt to secure funds to promote a State-wide electric range campaign, has not been able up to the present time to collect the $2,000 which it was estimated would be required. Twelve Indiana central stations have subscribed $872, and according to O. M. Booher of Kokomo, chairman of the new-business committee, it will probably be necessary to postpone the campaign. The pledges received will probably be held and additions made as soon as possible.

The obstacles which the committee has found are: First, high cost of range installations; second, lack of enthusiasm on the part of central stations in regard to electric range load being profitable; and third, the small number of electric range rates among the Indiana companies.

Furthermore, the committee believes that it is unfortunate that the price of ranges should have been advanced at this time and that range manufacturers have expressed themselves as unable to contribute to the campaign.

INTEREST GROWS IN THE "WIRE-YOUR-HOME" CONTEST

Salesmen of Members of the Society for Electrical Development Are Anxious to Try for a Share of the $1,250

Since the announcement regarding the "Wire-Your Home-Time" prize contest was placed in the hands of the central station solicitors and the salesmen of the contractors the Society for Electrical Development has

been kept busy with inquiries for contest blanks. The requests have come from all sections.

The cover of the comprehensive booklet issued by the society in connection with the "Wire-Your-Home" plan is reproduced herewith.

IMPORTANCE OF EFFICIENCY IN GENERATING STATIONS

Samuel Insull, in His Pittsfield Address, Says That Far Greater Improvements Are Necessary to Overcome Additional Costs

During his remarks at the dinner of the Pittsfield (Mass.) Section of the American Institute of Electrical Engineers on the evening of March 14, Samuel Insull, president of the Commonwealth Edison Company of Chicago, called attention to the growing importance of efficiency in the generating station. A brief telegraphic report, covering some of the points in the address of Mr. Insull, was published in last week's issue.

"The great increase in the cost of fuel, labor and every other element which makes up the station cost," Mr. Insull said, "has such a serious effect on the balance sheets that far greater improvements in stations must be made if these additional costs are to be overcome.

"Demands for greater improvements in turbines and boiler construction are bound to come, and these demands are going to be far beyond what they have ever been in the past. I don't know where these improvements are coming from, but it is a problem the engineers of to-day must solve. Within the next few years I expect to see improvements made that will bring about 25 to 30 per cent better results than are being obtained in stations to-day."

Mr. Insull spoke of the importance of prompt delivery of apparatus and of the extent to which the manufacturing end of the industry is dependent upon the consuming or operating end, which cannot turn its capital more often than once in five years. The prosperity and development of the producer depend upon the consumer.

Mr. Insull also expressed the opinion that companies should not consider reductions in rates while the trend of costs is upward, as at present.

MINNESOTA ASSOCIATION LOOKS AHEAD IN ELECTRIC RANGES

Tenth Annual Meeting, Held in St. Paul This Week, Indicates That Nearly All of the Companies Have Sold a Few of These Appliances

Construction, maintenance and inspection of distribution systems, service for towns of less than 1500 inhabitants, the effect of load factor on operating costs, how central stations are using technical schools, the principles of rate making and electric cooking were the topics discussed at the tenth annual meeting of the Minnesota Electrical Association at St. Paul, March 20 and 21.

The paper on distribution systems, which was written by S. B. Hood of the Minneapolis General Electric Company, presented a fund of useful and sound information gathered as the result of the author's experience in building and operating distribution systems of the prevailing types in many communities. It contained valuable ideas and opinions on the selection of line material.

Earl D. Jackson, consulting engineer, St. Paul, speaking on twenty-four hour service in towns of less than 1500 people, gave some estimated and actual cost data comparing the price of locally generated energy and energy purchased from transmission companies. The paper brought out the limits of rates which towns of various sizes can afford to pay for transmitted energy.

A paper on load factors and operating costs, by M. Barnert, Minneapolis, contained data and curves to show how under assumed conditions the cost of producing energy would fluctuate with varying load fac-

tors in a system of combined hydroelectric and steam plants.

STUDENT WORKERS FOUND SATISFACTORY

Prof. George D. Shepardson, University of Minnesota, discussed "How Central Stations Are Making Use of Technical Schools." He reviewed the co-operative work of engineering colleges and member companies of the National Electric Light Association. In 1916, he said, 94 per cent of the companies temporarily employing college undergraduates declared them to be more satisfactory employees than the average new men, 4 per cent believed them just as good as the average and 2 per cent were not so well satisfied with their work.

Prof. W. T. Ryan, Minneapolis, speaking on the principles of rate making, characterized the desirable schedule as the one that is fair to the consumer, profitable to the central station, easily understood by the layman, not offensive to the small lighting customers' sense of justice and tending to induce all customers to increase consumption with economy to themselves and profit to the company. He expressed opposition to the value of service theory and favors the cost of service theory in rate making.

NEW ELECTRICAL ENGINEERING BUILDING FAVORED FOR MINNESOTA

A resolution was passed and ordered sent to the Legislature placing the association on record as favoring a new $160,000 electrical engineering building for the University of Minnesota.

The presentation of the two commercial addresses. "Electric Cooking," by E. H. Adler of Minneapolis, and "Selling Service," by Harry W. Alexander, New York, was followed by discussion. In all but the largest Minnesota cities electric ranges are still being introduced on a limited scale. Nearly all of the companies have sold a few ranges, however, and the managers evidenced live interest in the electric cooking experiences of others, in the various opinions on range rates and the profits in the electric cooking business.

There was every indication that many range campaigns will be conducted in Minnesota this spring.

HEARING ON SAFETY RULES FOR WISCONSIN UTILITIES

Railroad Commission and Industrial Commission Learn that Electric Utilities Favor Trial Adoption of Condensed Draft of Code

At a joint hearing conducted at Milwaukee, Wis., on March 16, by Walter Alexander, chairman of the Railroad Commission of Wisconsin, and J. D. Beck, chairman of the Industrial Commission of Wisconsin, public utility operators were given an opportunity to present views on a draft of proposed electrical safety rules for Wisconsin.

This draft, which in its present form is a twenty-six-page pamphlet, is a condensed edition of such parts of the National Electrical Safety Code as are deemed to be applicable to Wisconsin conditions. It is understood that when the commission engineers are satisfied that the rules are workable for the utilities in the State, they will be made the subject of an order to be issued by the two commissions.

In the discussion the light and power and street railway operators favored the adoption of the proposed draft for a suitable trial period.

Requests by the chairman for specific objections on the supposition that the rules were to be made mandatory showed that the objections of the telephone interests were confined to the grades of construction, and factors of safety required for wood poles, both of which they regarded as insufficiently severe to protect their lines.

They propose that the grades of construction be changed so that, instead of having supply lines over 5000 volts where exposing signal lines in crossing conflicts and common use of poles, divided into grades A and B construction, there should be only one grade for such construction, and that the stronger Grade A.

The electricity supply and electric railway companies were represented by a committee from the Wisconsin Electrical Association, composed of S. B. Way, Milwaukee; Lee Lathrop and M. C. Ewing, Wausau. Among the others who were present and participated in the discussion were Dr. E. B. Rosa and W. J. Canada, Bureau of Standards, Washington, D. C., and H. P. Gear, Chicago, representing the National Electric Light Association. Dr. Rosa described fully tests made by the bureau on telephone protective devices and defended the 7500-volt potential limit fixed by the code. He said he considered it a fair limit for all concerned.

The commissions gave no assurance that the rules would be either mandatory or tentative, and it was suggested that they might be made partly mandatory and partly tentative. This construction was placed on the word "tentative," *i.e.*, certain rules classed as tentative would be actually in effect unless a utility objecting to them presented informally reasons why in specific cases they should not be put into effect. Under such conditions the commissions will pass on the informal objection, and either refuse or grant permission to do work contrary to the rules.

ELECTRICALLY-LIGHTED NAVAL WINDOW DISPLAY

Merchants Can Assist Recruiting Campaign of the Navy Department by Using Their Space for Patriotic Exhibits

The Navy Department is interested in securing enlistments. Many merchants would be willing to co-operate with it by making electrically-lighted window displays.

Department stores with toy departments can add to the display such articles as toy battleships, destroyers, submarines, etc. A silk flag can be made to wave by the use of a small electric fan.

ATLANTIC DIVISION JOBBERS FAVOR LOWER INITIATION FEE

Merchandising of Staple Products Receives Attention at the Meeting in New York—W. E. Robertson of Buffalo Is the New Chairman

The merchandising of staple products was the topic that received the greatest attention at the meeting of the Atlantic division of the Electrical Supply Jobbers' Association, Hotel Biltmore, New York, on March 15. The lines that received particular attention were dry batteries, heating devices, sockets and switches.

A resolution providing that the chairman of the division shall not be elected to succeed himself was passed. This limits the consecutive period of office to one year. A recommendation was passed that the initiation fee to the Electrical Supply Jobbers' Association be reduced. Final action on this recommendation will not be taken until the meeting of the entire association at Hot Springs, Va., on May 23-25. Another recommendation that activities of each division be directed by the members of the national executive committee from the respective divisions was also passed.

O. D. Street, Western Electric Company, New York, read a paper giving a comprehensive analysis of the small-quantity business of the electrical supply jobber.

The following officers were elected for the ensuing year: Chairman, W. E. Robertson, Buffalo; executive committee members from the East, M. Havens, Jr., F. R. Elliott, George Patteron, F. S. Price, H. S. Savage, W. I. Pickford and E. C. Graham.

CO-OPERATION OF JOBBER AND CENTRAL STATION

Committee of the Electrical Supply Jobbers' Association Asks Executive Committee of the National Electric Light Association to Promote Joint Action

A committee of the Electrical Supply Jobbers' Association attended the meeting of the executive committee of the National Electric Light Association at the New York headquarters on March 9 to discuss ways and means of closer co-operation.

E. W. Rockafellow, Western Electric Company, was the chairman of the committee of jobbers. He stated that the Jobbers' Association has about 150 members, doing a business of $80,000,000 to $90,000,000 a year.

At the request of Mr. Rockafellow, Thomas M. Debevoise, general counsel of the association, explained the objects and accomplishments of the organization. He said that the jobbers realize that they cannot stay in the field unless they can prove to manufacturers that they are the most economical means of getting goods from factory to consumer; that that is the basis on which they go to manufacturers and that is the basis on which they came to the N. E. L. A. requesting co-operation. They are ready to put their organization at the service of the central stations if the central stations will co-operate with them in a movement which ought to redound to the advantage of both.

President Wagner of the N. E. L. A. said that that association believed in co-operation, and that he was sure that it believed in co-operation with the jobbers. He asked if the jobbers had any suggestions to offer as to definite means of co-operation.

Mr. Rockafellow said that he had not anticipated that sufficient time would be given for discussion of the details involved, but that the members of the committee had come to introduce themselves and to impress upon the executive committee that they were an economical factor in the business. They thought that Mr. Wagner might appoint a committee to meet a committee of the jobbers.

It is expected that a committee will be named in the Commercial Section.

STANDARDIZATION MOVEMENT FOR APPLIANCE PLUGS

Manufacturers of Heating and Other Appliances Meet N. E. L. A. Wiring Committee—Committees on Round Prongs and Flat Prongs to Continue Discussion, and General Meeting Will Follow

A meeting of manufacturers of heating and other appliances was called for March 15 by the wiring committee of the Commercial Section of the National Electric Light Association, to consider the question of standardizing the plugs by which the various appliances are connected to the portable cord. At the meeting, which was held at the headquarters in New York, the following were present: R. S. Hale, S. E. Doane, C. A. Bates, Willis H. Booth, John A. Campbell, J. C. Dallam, A. H. Fleet, A. G. Kimball, J. H. Kleigl, Robert Kuhn, E. N. Lightfoot, J. P. Mallett, H. J. Mauger, T. A. McDowell, M. C. Morrow, H. J. Morey and by letter J. F. Killeen and H. T. Pelonze.

The meeting was opened by Mr. Hale, chairman of the wiring committee, who stated that the general purpose was to begin standardization by discussion, and that the N. E. L. A. would not itself take any action unless and until there should be substantial agreement among the manufacturers.

After a general discussion, during a portion of which Messrs. Hale, Doane and Mallett withdrew, it was decided to appoint two committees as follows:

Committee on round prongs: A. G. Kimball, Robert Kuhn, H. J. Mauger, E. N. Lightfoot and a representative of the Simplex company. Committee on flat prongs: W. H. Booth, F. Thornton and H. T. Pelonze.

Mr. Hale will be a member and secretary of both committees. Each of these committees will consider the subject and submit to another general meeting reports giving the arguments and experience as to why round or flat prongs will be the best design for a standard. They will also suggest the best dimensions and specifications in case either should be adopted. The reports will also include the question of guides on appliances.

The committee on round prongs will meet at 10 a. m. on May 26, at the N. E. L. A. rooms, New York, the committee on flat prongs at 1 p. m. on May 28, for lunch in Atlantic City, at a hotel to be decided later.

Each member of these committees is requested to send to Mr. Hale by May 10 if possible a statement of reasons for his preference for round or square prongs, and suggestions as to specifications and dimensions.

In addition, and since it is possible that the committees may not adequately represent the manufacturers of either or both types of prongs, any other manufacturer who desires is requested to send a similar statement, and also to notify Mr. Hale if he would like to be present at the meeting of either committee.

If any manufacturer wishes to present the claim of any other form of connection than the round or flat prong he is requested to send the same to Mr. Hale.

The two committees will prepare reports which will not be published, but will be sent to the manufacturer interested. Any manufacturer not represented at the meeting on March 15 is requested to notify Mr. Hale if he wishes to be advised of these reports.

A further general conference of manufacturers will be called during the summer, or early fall.

CONNECTION WITH NEW ENGLAND POWER COMPANY IS ECONOMIC

Noteworthy Support Given to Fall River Electric Light Company Project by Municipal Authorities, Commercial Organizations and Influential Citizens

The Massachusetts Commission on Waterways and Public Lands gave a hearing at Boston recently upon a petition of the Fall River Electric Light Company for authority to build a 66,000-volt aerial transmission line crossing of 1800-ft. span over the Taunton River to enable the company to enter into a contract with the New England Power Company for the supply of energy in connection with the existing turbine station of the former company in Fall River. The hearing was of much engineering interest on account of the discussion of the project before the commission by Philip Cabot of Boston, vice-president of the Fall River company, and it was also noteworthy on account of the support rendered to the company by the municipal authorities of Fall River, the local board of trade and merchants' organization, and many influential citizens.

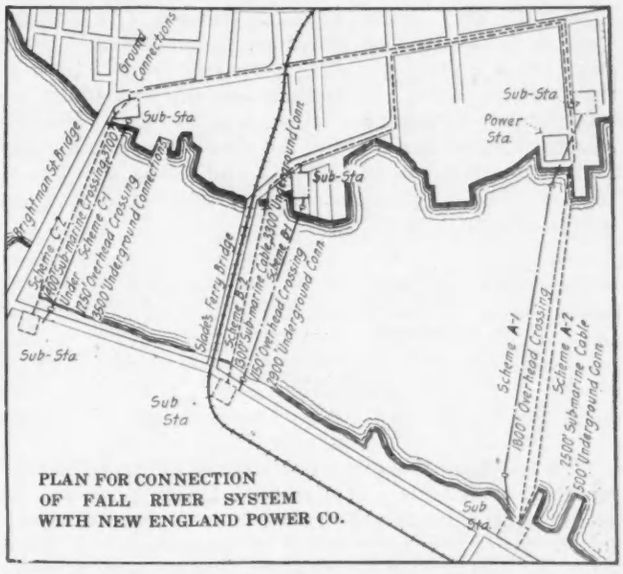
W. Rodman Peabody of Boston, counsel for the company, objected to a proposed delay in the proceedings. He said that as the price of steel for towers has increased by several thousand dollars while the petition has been pending, further delay was unfair.

MERCHANTS AND MILLS BENEFITED

Mayor James H. Kay of Fall River said that he firmly approved the aerial crossing, and that with the tie-in proposed with the large system of the New England Power Company merchants and mills in the city would be all the more willing to purchase central station energy. The Mayor said that he understood there would be a large increase in the taxable property of the company if the new construction went through. W. A. Beatty, vice-president of the Pilgrim Mills, said that this establishment was the first textile plant to be driven by central station energy in the city, and that it is the largest user of electricity on the company's lines. The speaker favored authorizing the overhead span. C. B. Chase, for the Stevens Manufacturing Company, which has recently installed auxiliary central station power service to assist in meeting the expansion of the mill business instead of extending its own power plant, said that the increased reliability of service would be valuable to the textile industry, which is closely dependent upon continuous operation.

Vice-President Cabot of the company said that it reached the limit of its capacity last December and has no spare equipment. Connection with the New England system is designed to bring an additional regular supply of primary power into the plant to enable it to most economically meet the demands of future business, especially in the textile field. Fall River, Mr. Cabot stated, is the least developed electric power market of any city of its size in the country, more steam power in proportion to its size being in use there than anywhere else. The margin of profit in supplying electricity to textile mills is very narrow, only 0.1 cent per kilowatt-hour, and this means that every possible economy in production and distribution must be sought. Any day the company is liable to be confronted with a demand for 5000 to 10,000 kw. in new mill business. It must be prepared to serve the public even on the foregoing small margin of profit or else give place to a more energetic organization. At a first cost of about $248,000 for the aerial crossing, necessary substation, conduit and related work 30,000 kw. can be added to the Fall River system, whereas additional local steam plant capacity to this extent would cost probably $2,000,000.

The proposed river crossing would have a span of 1800 ft., the minimum clearance of the 5/8-in. copper-clad steel cables to be used being 140 ft. above mean high water. Two 230-ft. steel towers would be erected on the Somerset and Fall River shores respectively and the crossing would be made by two three-phase circuits. Mr. Cabot said that the location settled upon is the result of analyzing six different schemes. The span proposed is the least expensive in first cost and in annual operating expense, including fixed charges. The preferred plan provides an aerial crossing higher than Brooklyn Bridge, with a clearance of at least 10 ft. above the topmast of any vessel of American registry at mean high water. All switching in the substation on



PLAN FOR CONNECTION OF FALL RIVER SYSTEM WITH NEW ENGLAND POWER CO.

the Fall River side will be controlled from the power plant switchboard. Transformers of 30,000 kw. combined rating will have windings connected for 66,000, 22,000 and 4200 volts. Energy may be distributed at 22,000 and 4200 volts, or the equipment in the power plant may be utilized in delivering 22,000-volt energy to the mills. Mr. Cabot said that the proposal to carry the 66,000-volt line across the river on the existing bridge structures was entirely unsafe, apart from its unsightly features.

The preferred scheme of a direct high-tension crossing by aerial cable, Mr. Cabot said, means from $22,000 to $59,000 less first cost in the crossing and connections than in the other schemes; from $71,000 to $56,000 less initial cost in substations, and from $93,000 to $115,000 less initial cost for the total installation. As the initial installation would be only one-half the ultimate, the total annual excess cost of the five alternative schemes over the preferred crossing would range from $17,600 to $18,600. Mr. Cabot said that if the commission denied the petition, the expenditure of about $100,000 more for any of the alternative schemes would make the project prohibitive to the company.

The estimated cost of the preferred crossing is as follows: Land in Somerset, $4,000; tower footings, $15,000; towers, $15,000; wires, $4,000; total overhead crossing, $38,000; underground connections with the existing plant, $5,900; land at the power station, $10,000; 66,000-volt transformers, $70,000; lightning arresters, $4,000; 66,000-voltmeters, $5,000; 66,000-volt switching apparatus, $16,000; 22,000-volt switching apparatus, $80,000; 4000-volt switching equipment, $15,000; substation piping, etc., $5,000; grand total estimated cost, $248,900. The total annual cost of the preferred scheme came to $41,470, of which $11,600 was in operating expenses and $29,870 in fixed charges.

SCRAP SALES HELP NORTHERN CALIFORNIA POWER COMPANY

Opportunity to Replace Aluminum Transmission Wire with Copper Line of Higher Voltage Promotes Economy and Prospects

Of $846,227 gross operating revenue of the Northern California Power Company, Consolidated, in 1916, $768,788 came from electricity, $35,505 from gas and $41,934 from water. Operating expenses, taxes and depreciation reserve were $375,789, leaving net earnings from operation of $470,438. Profits on merchandise sales were $11,221, making total net income of $481,659. Deducting interest of $352,920 and miscellaneous charges of $517, leaves $128,222 balance. An unusual item is "miscellaneous additions to surplus and profit on sales of junk," $57,039, comparing with $2,165 in the previous year. Valuation account and other extraordinary deductions from surplus took $54,551. Against the balance of $130,710 there were due sinking fund appropriations of $133,825, indicating a deficit of $3,115. The proportions of the different classes of electric business were:

		1916	1915
Light earnings:	Residence and commercial	$134,427	$133,249
	Municipal	22,273	19,726
Power earnings:	Commercial	67,512	61,274
	Municipal	6,623	6,279
	Irrigation	95,350	64,670
	Mining and dredging	205,373	183,213
	Other electric companies	213,481	212,667
	Other departments	23,749	23,555
		$768,788	$704,633

W. F. Detert, the president, estimates in the annual report to stockholders that in 1917 50,765 acres will be irrigated by pumped water, the pumps being electrically operated with power furnished by the company. Of plant additions and system changes the report says in part:

"Owing to increased demands, particularly in the more southerly portion of the territory, it has been necessary to adopt a definite plan having for its object the operation of all transmission lines at 60,000 volts, except in the mining section in Shasta County, where it is still feasible to operate at 20,000 volts over a portion of the system. The necessary steps involve construction of some new 60,000-volt lines, increase of copper wire capacity on others, a change in the equipment and arrangement of a number of substations and the dismantling of 20,000-volt lines which it is not desirable to retain for operation as low-voltage distribution circuits. It has been possible to take down practically all of the aluminum wire on lines between Red Bluff, Butte City and Chico and to replace same with copper wire of increased capacity where required. Up to the end of 1916, 150,000 lb. of aluminum wire had been taken down and sold at a net profit of $31,197 over its cost price. This has, of course, assisted very materially in defraying the cost of these changes. During 1916, $295,513 was invested in additional water rights and betterments and additions to the system in general. Purchase of water rights necessary for the operation of present plants and land which we were compelled to purchase with the water cost $77,220; additions and betterments to electric facilities, $208,000.

"Various lines or portions of lines were dismantled, the original cost of which amounted to $103,199, so that the net increase in investment values for the year was $192,314. From the lines dismantled material was recovered having a salvage value of $87,993. The cost of dismantling amounted to $2,942. A total of 36.7 miles of new primary distribution lines was constructed and 482 new services of a combined length of 68,114 ft. were installed.

"One new line is designed among other things to serve the Western States Gas & Electric Company, with which a contract has been made to furnish it with power which it may require for its Eureka district in excess of the output of its present generating facilities."

ELECTRIC COOKING DISCUSSED IN WISCONSIN

Experience of Milwaukee Company with the Electric Range—Safety Rules of the Railroad Commission—B. F. Lyons of Beloit Elected President

On the second day of the convention of the Wisconsin Electrical Association at Milwaukee, March 15, interest centered on a paper entitled "Electric Service for Domestic Cooking," by R. B. Snyder, sales manager of The Milwaukee Electric Railway & Light Company. Under Milwaukee conditions, Mr. Snyder showed, the characteristics of the cooking load make it a desirable one. He supplemented his arguments by data from actual range installations at Milwaukee. He said that the extra investment required to serve a range customer was only $35, or less than the investment originally required to serve the average residence customer, whose bills are about one-third those of a cooking customer. Mr. Snyder also spoke of the necessity that the sales department should have ready co-operation from the service and trouble departments to make ranges give satisfaction.

In the discussion Egbert Douglas of Milwaukee expressed the belief that characteristics of range loads taken from present installations should not be used as an absolute basis for predicting what will be the characteristics of the future cooking load, when there will be many more customers than to-day. He believed that electric cooking would fall largely on the evening lighting peak, and declared himself for cooking rates that took this encroachment on the peak into consideration.

This statement was answered by operators who have been offering cooking rates. C. L. Kuehlthan of West Bend, Wis., said that after offering trial range installations on a 3-cent rate for eighteen months he now had 4 per cent of his former lighting customers cooking electrically. In a city like West Bend with 3000 people the heavy cooking peak is at noon.

G. W. Van Derzee of Milwaukee pointed out that the experience of gas companies in Watertown and Kenosha, Wis., showed the cooking peak to be at noon. He said further that he expected the cooking business to have a diversity factor of ten.

Safety Code

Another topic of general interest was the new safety code which the Railroad Commission of Wisconsin has presented in tentative form for discussion by utility operators.

As explained by J. N. Cadby, electrical engineer for the commission, this code is a much condensed revision of those parts of the National Electrical Safety Code which are applicable to Wisconsin conditions. The National code contains 323 printed pages. The proposed Wisconsin code contains twenty-six similar pages. The National Electrical Safety Code could not be adopted as a whole in Wisconsin because parts of it conflict with the Wisconsin law and because it deals with industrial work over which the Industrial Commission and not the Railroad Commission has jurisdiction. The spirit and requirements of the proposed Wisconsin code are, however, substantially the same as those of the National Electrical Safety Code. A great deal of work was done to shorten it without eliminating rules necessary for

companies in the heavy loading district. It was the commission's plan to have its inspectors use the National Electrical Safety Code as a guide in administering the Wisconsin code.

A discussion of the Wisconsin code in detail was held at Milwaukee the day after the convention.

Other papers and addresses were as follows: "Plans for Wire-Your-Home Time, April 1 to May 15" by Harry W. Alexander, Society for Electrical Development, New York; "One-Man Car Operation," by Raymond P. Smith, Sheboygan, and "Transmission Problems," by G. W. McIvor, Jr., Eau Claire, which was read by A. E. Pierce of Eau Claire.

NEW OFFICERS

The election of officers resulted as follows: President, B. F. Lyons, Beloit; first vice-president, A. E. Pierce, Eau Claire; second vice-president, John St. John, Madison; third vice-president, F. C. Ludden, Mineral Point, and secretary-treasurer, George Allison, Milwaukee.

LARGE GROSS SALES OF THE WESTERN ELECTRIC COMPANY

Profits on Telephone Apparatus Not Proportional to Volume but Satisfactory on Cable and Merchandising of Quick Turnover—Manufacturing Conditions Difficult

Unsatisfactory manufacturing conditions affected the operations of the Western Electric Company during 1916. Gross sales, however, increased 67.6 per cent over 1915. H. B. Thayer, the president, indicates the extreme conditions of business in the different departments, the large increase in employees and the uncertainty of the situation in the foreign plants. Mr. Thayer says:

"The profits of the company are derived from the sale of telephone apparatus and cable of our own manufacture, and the sale of merchandise not made by us, and from our investments in foreign manufacturing companies in similar lines of work.

"While the output of telephone apparatus has been large in 1916, the deliveries were principally during the latter part of the year and on orders received considerably earlier in the year, as in this class of work some months elapse between the beginning of the process of manufacture and the final delivery of the finished apparatus. The costs of all the items going into the cost of manufacture have rapidly increased during the year, so that the profit on this department of the business has not been proportional to the volume.

"On sales of cable and merchandise not of our own manufacture, where the turnover is quick, the profits have been satisfactory.

"As to the foreign manufacturing companies in which we are interested, our information as to the most of them is meager, but we understand that they have, with the exception of the one at Antwerp, Belgium, been employed on fairly profitable work during the year. Whether a satisfactory profit will remain after the payment of war taxes in the several belligerent countries is not so certain. No dividends have been received by us, so that our foreign investments have made no contribution to our profits of the year, as shown in the statement.

"Manufacturing conditions in this country during the year have been extremely difficult. It has been almost impossible to provide a regular supply of material, not only on account of the general shortage, but also on account of the uncertainties of freight transportation. The demand for our products increased very rapidly during the year and the necessity of meeting this demand has taxed all available resources for machinery, tools and other expense items.

"Our shop force increased during the year from 10,838 to 18,928 employees. The total number of employees at Dec. 31, 1916, was 26,878. In recognition of the loyalty and efficiency with which the employees have met and are meeting the difficult conditions of the present time, your directors authorized the distribution of certain extra payments to them.

"The sales for 1916 were $106,987,000. For 1915 they were $63,852,000, and for 1914 they were $66,408,000. The orders on hand at Dec. 31, 1916, were $22,028,000 in value more than on Dec. 31, 1915. The average value of an order filled during 1916 was $75 as compared with $55 for 1915.

"The total disbursements from the employees' benefit fund for 1916 amounted to $185,344. These payments covered all classes of benefits and were made to 2789 beneficiaries."

The financial statements of the company and its constituent companies in the United States show that to the gross sales of $106,986,677 other income of $1,229,636 was added, making a total of $108,216,313. Cost of merchandise was $95,936,433, expenses were $7,014,254 and taxes were $587,050; there was appropriated for special payments to employees $973,866 and for reserve for contingencies $500,000. The balance available for interest and dividends was $3,204,710. Interest was $880,094, dividends were $2,100,000 and $224,616 was carried to the common stock.

The balance sheet for the same companies, as of Dec. 31, 1916, follows:

ASSETS		LIABILITIES	
Real estate and buildings	$11,633,290	Preferred stock, 150,000 shares	$15,000,000
Machinery and equipment	9,209,532	Common stock, 150,000 shares no par value.	25,453,648
Total plant	$20,842,822	Bonded debt	15,000,000
Merchandise	33,001,524	Total capital liabilities	$55,453,648
Cash	5,328,180	Bills payable	5,500,000
Bills receivable	1,085,520	Accounts payable	12,334,003
Accounts receivable	18,109,258	Reserve for depreciation on plant	13,320,143
Total current assets	$57,524,482	Reserve for employees' benefit fund	1,000,000
Sundry investments	12,041,068	Reserve for contingencies	2,800,578
Grand total	$90,408,372	Grand total	$90,408,372

INTERIOR DEPARTMENT OFFICIAL FOR WATER POWER MATTERS

E. C. Bradley, of San Francisco, Formerly of the Pacific Telephone & Telegraph Company, Made Assistant to Secretary Lane

E. C. Bradley of San Francisco has been appointed assistant to the Secretary of the Interior, according to an announcement by Secretary Lane in Washington. Up to the time of his retirement from active business life two years ago Mr. Bradley was vice-president and general manager of the Pacific Telephone & Telegraph Company.

Mr. Bradley succeeds to the position formerly held by Adolph C. Miller, now a member of the Federal Reserve Board, which was also formerly held by Stephen T. Mather, who becomes director of the National Parks. Mr. Bradley was at one time superintendent of telegraphs of the Pennsylvania Railroad. He also has served as general manager and vice-president of the Postal Telegraph Cable Company.

It is expected in Washington that Mr. Bradley will become the public utility expert of the Department of the Interior, and that he will have much to do with the administration of water-power matters.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public-utility companies.

Delegation of Rate-Fixing Power to Municipality.—Since the right to regulate rates is an inherent element of sovereignty, such right can be delegated to a municipality only by clear and express terms, and all doubts must be resolved against the municipality, it was held by the Supreme Court of Oregon in the city of Woodburn vs. Public Service Commission of Oregon (161 P. 391). The right to regulate rates is a matter of general concern, and does not pertain solely to municipal affairs. Where a municipality under its home rule charter granted a telephone franchise limiting rates to be charged and later the public utility act was enacted, the Public Service Commission had authority thereunder to authorize the company to charge higher rates. When an owner devotes his property to a use in which the public has an interest, he must submit to be regulated and controlled by the public for the common good. The regulation of rates for the purpose of promoting the public health, comfort, safety and welfare is an exercise of the police power of the sovereign.

Public Within the Meaning of Employers' Liability Law.—An interesting decision was handed down in the case of Clayton vs. Enterprise Electric Company (16 P. 441) by the Supreme Court of Oregon, in which it was held that the employers' liability law, which provides for the safeguarding of transmission and distribution lines at all points where people are liable to come in contact with them, was intended to safeguard members of the public from coming in contact with wires carrying a dangerous current, and was not limited to the protection of the immediate employees of electric companies. The action was brought to recover for the death of the plaintiff's husband, caused by an electric shock which he received by attempting to turn off the power furnished by the defendant of a motor pump operated by a private individual by whom the deceased was employed. The court held that where an electric company furnished the energy for operating a pump owned by an individual and owned the wires leading to the switch which was installed by the company's predecessors, the company can exercise control over the switch even if it does not own it, and is liable under the employers' liability law if the switch is defective. And again, where an electric company undertakes to render service to a customer and runs its wires into a building and installs its apparatus therein, it must exercise a degree of care commensurate with the risk in protecting and insulating its wires and installing the apparatus.

Tree Cutting Liability.—Employees of both an electric light company and a telephone company entered plaintiff's premises and cut and disfigured her shade trees during the stringing of a new telephone line. Both companies and all who participated in the act as their agents were held by the St. Louis (Mo.) Court of Appeals (190 S. W. 612) jointly and severally liable for the damages. It was held to be no defense that a street commissioner of the city was present, giving orders and directions regarding such cutting, it not appearing that the commissioner had authority to direct such cutting nor that the branches were cut for any other purpose than to aid the telephone company.

Injury to Employee.—In an action by an employee injured in loading poles on a truck evidence was held to warrant a finding that the employer was guilty of negligence in furnishing a defective wooden horse to elevate one end of the pole, by the District Court of Appeals for the First District of California at a rehearing denied by the Supreme Court in the case of Hansen vs. Sierra & San Francisco Power Company (162 P. 924). An award of $11,310.05 to an employee thirty-two years of age, in strong condition mentally and physically with an earning capacity of $85 per month, for personal injuries which affected him both mentally and physically, cannot be held excessive.

Right of a Municipality to Purchase Under an Indeterminate Permit.—Under the public utilities statute of Wisconsin as to acquisition by a municipality of a public utility, providing that a public utility by acceptance of an indeterminate permit shall be deemed to have consented to a future purchase of its property by the municipality in which its property is, for the compensation and under the terms and conditions determined by the commission, and shall thereby be deemed to have waived the right of requiring the necessity of such taking to be established by the verdict of a jury, a proceeding under this statute by a municipality to acquire the property of a utility operating under an indeterminate permit, although termed a purchase, was in the nature of a condemnation proceeding, it was held by the Supreme Court of Wisconsin in Connell vs. Kaukauna Gas, Electric Light & Power Company (159 N. W. 927) since the acceptance by the utility of an indeterminate permit amounts only to a waiver by it of a verdict of necessity and a consent that its property may be acquired as provided by the act, but is not a contractual act. In a proceeding by a municipality to acquire a public utility under the statute, it was the municipality's duty to see that the amount of bonds outstanding under a trust deed on the property of which the city had notice was applied to the claims of the bondholders either by payment of the money into court for distribution or by securing consent of the bondholders to pay it to the trustee, or in the event that they would not consent to such payment, to wait until they asserted their rights in the fund.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Permissible Earnings on Stock.—In a decision affecting the St. Croix Gaslight Company the Maine Public Utilities Commission says that a fair rate "should be a rate which, when applied to the probable output of the company, will produce a revenue sufficient to yield such a dividend on an amount of capital exactly equal to the fair value of the property as will induce others to invest capital in similar enterprises with the expectation of getting their recompense from the normal earnings of the enterprise, not from the flotation of its securities."

Installation of Services and Meters in New York.—A general order establishing rules and regulations covering the installation of electrical services and meters, and the materials to be used therein, approved by the New York Public Service Commission, First District, is to take effect on April 1, 1917. No electrical corporation furnishing energy within the jurisdiction of the commission shall thereafter install or put in use on any service to a consumer's premises any appliance, device, switch, fitting or instrument transformer the type of which shall not have been approved by the commission. A service, for the purposes of the order, is defined as that part of the circuit, and all equipment pertaining thereto, between a main of the electrical corporation and the consumer's circuit. A service transformer secondary is considered a main. Following is the schedule of fees to be charged a manufacturer for each complete test: Conduit, metal molding, and fittings, each type, $2; armored, lead-covered, insulated cables or wires, $2; fuses, fuse blocks, insulators and ground clamps, $2.50; metal boxes and cabinets, each size, $2.50; knife switches, $4; circuit breakers, $5; potential transformers, 3200 volts or less, $6; 6600 volts, $8; current transformers, 250 amp. or less, $8; 300 to 450 amp., $12; 500 to 800 amp., $15; 1000 amp., $17. Protective devices, testing combinations, miscellaneous equipment, or service equipment with an ampere capacity in excess of 1000 amp., or a voltage rating in excess of 6600 volts, will be charged at the rate of $1 per hour per man for the time required to determine its serviceability, the minimum charge to be $3, and the maximum charge not to exceed $50. Whenever service equipment is submitted so that it is represented in more than three sizes or ranges, and it is found that tests of each range or size are not necessary to determine the serviceability of the type, the fee then charged will be as per schedule for each device tested, and for each device in addition to those tested only $1 per device will be charged.

Electricity at Mississippi Centennial Exposition.—Electricity and the electrical industries are to have a part in the Mississippi Centennial Exposition, opening at Gulfport on Dec. 10, 1917. Harry Chapin Plummer, industrial agent of the exposition, 505 Fifth Avenue, New York, has designed a "Plantation Electrical," to afford opportunity for the display and demonstration of electrical apparatus, as applied to the processing of standard products of the Gulf States, such as cotton, rice, sugar, tobacco, corn and lumber. Irrigation will be an important feature. A bungalow or dwelling will be included, to show the newest electrical devices for the home.

Test Run of Electric Vehicle in Pittsburgh.—A test run was made in Pittsburgh by the Keystone Laundry Company of a Ward special light truck. Representatives of the laundry company, the Lawrence Motor Company, the Ward Motor Vehicle Company and the Duquesne Light Company were on board. The truck was fully loaded from the plant of the laundry company and was operated until the battery was run down, covering the worst hills in the Pittsburgh district. The load was not lightened and the truck ran 63 miles on one full charge of the battery. It maintained its rated speed. The laundry company has ordered four additional trucks of this type, equipped with Edison batteries.

Sales of Stock to Byllesby Company Customers.—During February, 173 customers of the Northern States Power Company purchased $63,900 of the preferred stock, making a total of $1,398,900 now held by 2698 customer-shareholders, of which $187,000 is being purchased on the partial payment plan by 772 customers. The San Diego Consolidated Gas & Electric Company is offering $219,000 preferred stock to customers. A similar issue offered last year was absorbed in a short time. The present issue has been authorized by the Railroad Commission for purchase of new properties, improvements and extensions. Up to March 9, thirty-nine customers had purchased $48,000 at 105 and interest.

Fund for British Engineering Profession Relief.—Seventy-six prominent engineers have joined in an appeal to the members of the engineering profession in the United States asking for contributions to the Professional Classes War Relief Council, Inc., which was organized in Great Britain shortly after the beginning of the war. The families of many professional men in Great Britain are experiencing privation. Major Leonard Darwin, a son of the naturalist, is chairman of the council. Jerrard Grant Allen is now in America representing the council. J. Pierpont Morgan has loaned to the council his house in Prince's Gate for use as a maternity hospital. At present the council is disbursing about $5,000 a week and the administrative expense is less than 2 per cent. Contributions may be forwarded to Lewis B. Stillwell, treasurer, care the Farmers' Loan & Trust Company, 475 Fifth Avenue, New York.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Changes Asked in Wiring Requirements in Victoria, B. C.—The council of the British Columbia Association of Electrical Contractors and Dealers has appealed to the City Council of Victoria, B. C., to change some of its wiring requirements.

Water-Power Acquisition in New York.—Howard C. Mather, treasurer, and Stefaan Piek, chief engineer of the Salmon River Power Company, appeared before the New York Public Service Commission, Second District, on March 5, and explained the company's need for the acquisition of the small water power below its own large project at Pulaski. The company proposes to take over the whole Pulaski development with its stocks, bonds, rights and privileges as a measure of protection for its own works as well as on account of the possible valuable development in the new acquisition. No opposition to the plans has been expressed.

Tariff Commission Nominated.—President Wilson has sent to the Senate the nominations of the following for the recently created Tariff Commission: Prof. Frank William Taussig, Cambridge, Mass., Independent in politics, for a term of twelve years; Daniel Calhoun Roper, McCall, S. C., Democrat, for ten years; David J. Lewis, Cumberland, Md., Democrat, eight years; William Kent, Kentfield, Cal., Independent, six years; William S. Culbertson, Emporia, Kan., Republican, four years, and Edward P. Costigan, Denver, Col., Progressive Republican, two years. Professor Taussig, who will be chairman, has been with Harvard University. He has obtained a leave of absence until September, 1918. Mr. Roper was formerly first assistant postmaster general. Mr. Lewis is a former member of Congress from Maryland. Mr. Kent is also a former member of the House of Representatives. Mr. Culbertson is special counsel for the Federal Trade Commission. Mr. Costigan is a lawyer. The commission is to investigate the administrative, fiscal and industrial effects of the customs laws, relations between rates of duties on raw products, effects of ad valorem and specific tariff duties, questions relative to the arrangement of tariff schedules and classification of articles, the effect of tariffs on industries and labor, etc. The commission has power to investigate tariff relations between the United States and foreign countries, commercial treaties, economic alliances, export bounties, preferential transportation, dumping, and production costs. The commission is to gather and place this information at the disposal of Congress and the President.

Energy for Springfield, Mass., Railway.—Negotiations are under way for the sale of electrical energy by the Amherst Gas Company to the Springfield (Mass.) Street Railway.

Salt Lake County May Sell Lines.—Salt Lake County is considering the sale of its lighting system to the Utah Power & Light Company, the Murray Power Company or the Progress Realty Company.

Utility Tax Law in New Jersey.—The Oliphant bill, increasing assessments on electric, gas, water and other utilities in New Jersey has been signed by Governor Edge. It authorizes an added tax of 1 per cent on the present 2 per cent tax on gross receipts during the present year, increasing to 4 per cent in 1918, and to a maximum of 5 per cent in 1919. All companies with gross receipts of less than $50,000 a year are exempt. It is estimated that the increased revenue for the present year will aggregate about $1,000,000.

Plan to Merge Long Island Companies.—The New York Public Service Commission, Second District, heard on March 7 the application of the Long Island Lighting Company to purchase and merge all but one or two of the small lighting companies of Suffolk County. Martin S. Decker, representing the company, told the commission that not only could greater economies of operation be accomplished but that through the tying together of the many plants, service could be improved and perhaps extended to intervening communities which have not hitherto had gas or electric service.

Art in Signs at Portland, Ore.—Building Inspector Plummer of Portland, Ore, who completed recently a survey of illuminated signs in Portland, in accordance with instructions from the City Council, found 237 signs without the amount of illumination prescribed in the ordinance, and sixty-seven which he classes as unsightly. He recommends that the Council revoke permits for the maintenance of unsightly signs and for others which are maintained in violation of the law, and suggests that in future the art commission be empowered to pass on designs before permits are granted.

Milwaukee Men in Naval Reserve.—Employees of the Cutler-Hammer Manufacturing Company of Milwaukee are the first Wisconsinites to be enrolled in the industrial branch of the United States Naval Reserve. Medical examinations have been completed among the 436 employees of the corporation. During times of peace, according to Ensign John L. Riheldaffer of the United States Navy, who mustered in the employees, they will be under no obligation except to keep their names on file. They are free to resign or change their positions at any time, he said. In times of war, however, they cannot resign from the reserve or change their positions. At all times they will be exempt from military duty. Examinations are now being made at the plant of the Allis-Chalmers Manufacturing Company, employees of which will also be enrolled in the naval reserve.

Worcester Polytechnic Institute Branch, A.I.E.E.—Edward Dana, manager of surface transportation of the Boston Elevated Railway Company, addressed the Worcester Polytechnic Institute branch of the A.I.E.E. on March 16. His topic was "Traffic Problems on a Large Urban Railway."

Dallas Electric Club and Jovian League.—On March 5, the Dallas Electric Club and Jovian League met jointly to receive the reports of two important committees, that of the Jovian committee appointed last meeting and that from the committee preparing the Electric Club float to be entered in the spring style show parade.

Electrical Development and Jovian League of San Francisco.—At the March 7 meeting of this organization, P. L. Thompson of New York, advertising manager of the Western Electric Company, gave a talk on "Selling the Electrical Idea." With the aid of lantern slides Mr. Thompson outlined the policy of educating consumers to the use of electrical devices first, and of selling a particular make of equipment afterward.

Intensive Membership Campaign, N. E. L. A.—The membership committee of the National Electric Light Association wishes to call attention to the intensive membership campaign which will prevail during the week March 26 to 31. Several hundred central-station executives throughout the country have been asked to call upon neighboring nonmember companies and extend them an invitation to join. The committee hopes that this will serve as a reminder.

St. Louis Jovians Aid in Red-Cross Organization. — Following addresses which were delivered before the St. Louis Jovian League at the Mercantile Club on Feb. 27 by James J. O'Connor, chairman of the Chicago Red Cross committee, and George W. Simmons, chairman of the St. Louis branch of the organization, the support of the St. Louis Jovians was assured the local Red Cross organization. Herman Spoehrer, secretary and treasurer of the Union Electric Light & Power Company, was appointed chairman of the Jovian committee to supervise the Jovian activities in the movement. C. W. Shands presided as chairman of the meeting, which was attended by about 100 members of the order.

"Steam Turbines and Reduction Gears for Ship Propulsion."—A joint meeting of the Portland sections of A. I. E. E. and N. E. L. A. was held in the Assembly Hall, Multnomah Hotel, Portland, Ore., on March 6, under the auspices of the A. I. E. E. A paper was presented by W. J. Davis, Sr., Pacific Coast engineer of the General Electric Company, on "Steam Turbines and Reduction Gears for Ship Propulsion." The paper included a description of flexible helical gears, their application to cargo ships, destroyers, scout cruisers, etc., electric drive for battleships and cruisers, the electro-magnetic clutch and the latest design of Curtis turbine. The paper was illustrated by lantern slides and sketches.

Associations and Societies

A complete Directory of Electrical Associations is regularly printed in the first issue of each month on the next-to-last text page.

Electric Club-Jovian League of Chicago.—E. B. Rosa, chief physicist of the Bureau of Standards, Washington, D. C., addressed the Electric Club-Jovian League of Chicago on March 15.

Spring Meeting, A.S.M.E. — The spring meeting of the A.S.M.E. will be held at Cincinnati, Ohio, on May 21-24, opening on May 21, instead of May 22 as previously announced. A feature of this meeting will be a joint session with the National Tool Builders' Association. Other sessions include discussions of problems relating to the manufacture of munitions, gas power, and machine shop practice.

New York Companies' Section, N. E. L. A.—The March meeting of the New York Companies' Section, N. E. L. A. was held in the Irving Place Auditorium, Fifteenth Street and Irving Place, New York City, on Tuesday evening, March 20. About 300 attended, the speaker of the evening being William Leslie French. The Women's Auxiliary of the New York Edison Company gave a dance following the meeting.

American Electrochemical Society.—The proposed program of the thirty-first general meeting of the American Electrochemical Society, to be held in Detroit, May 2 to 5, is as follows: Wednesday—Visits to automobile plants; "Get-together" roadhouse dinner; Thursday—"Electric Steel—Its Manufacture, Uses, Advantages and Hart Treatment; Abrasives; Ferro-Alloys; general electrochemical papers; and smoker. Friday—"Melting of Non-Ferrous Metals; also Various Low Temperature Electro-Thermic Processes"; Visits to electric steel plants, power houses, etc., and address by Mr. Alex Dow. Saturday—"Electro-Deposition of Metals; Rust Prevention" and miscellaneous papers.

Chile as a Field for Manufacturers and Investors.—Jose A. Del Campo F., commercial delegate of the Chilean government, will speak at a meeting held under the auspices of the National Association of Manufacturers at the Waldorf-Astoria (Astor Gallery), New York City, on March 29. Mr. del Campo's address will be illustrated by lantern slides and motion pictures and will contain a great deal of information from official sources of the immense opportunities which Chile offers to American manufacturers and investors in the development of its varied natural resources. Manufacturers of machinery, engines and motors should be specially interested in this lecture, as the pictures have been selected with the view of illustrating Chile's present industrial development and immediate future needs in this direction. Oil, coal and water falls are available for development.

Electrical League of Cleveland.—Judge Carl D. Friebolin addressed the Electrical League of Cleveland March 22 on the subject of "How Our Laws Are Made."

Association of Iron & Steel Electrical Engineers.—The eleventh annual convention of the Association of Iron & Steel Electrical Engineers will be held in Philadelphia, Sept. 10 to 14, inclusive.

Chemist Talks to Electrical Men.—That the war has given the American chemical industry a big boost was a point brought out in an address by Robert A. Miller, Jr., on March 2, at the weekly luncheon meeting of the Philadelphia Jovian Electrical League at the Hotel Adelphia. The speaker is research chemist for H. K. Mulford & Company and a nephew of Thomas A. Edison.

St. Joseph Jovians Hear Henry L. Doherty.—Before an assemblage of Jovians gathered in his honor at St. Joseph, Mo., on March 6, Henry L. Doherty stated that greater progress could be made by the railroads and utilities if there were less governmental interference. "One of the foolish theories advanced in this new fad of conservation is that the cutting away of the forests has caused floods succeeded by drouths. There is no better reservoir for water than tilled soil. And yet the idea has gained until it has stopped altogether the development of water power and has forced this country to burn millions of dollars worth of coal every year to make power that could be generated by the water power of this country." The necessity of having to sign an agreement to remove dams in case they interfere with navigation and to submit to regulation by the war department was cited as a reason for halting one hydroelectric project.

Annual Convention of Tri-State Water & Light Association.—The annual convention of the Tri-State Water & Light Association of the Carolinas and Georgia will be held at Macon on April 17, 18 and 19, and the indications are that the 1917 gathering will surpass all previous meetings of the organization. The president of the association, E. M. Anderson of Abbeville, S. C., held a conference with the secretary-treasurer, W. F. Steglitz at Columbia, S. C., and prepared tentative plans for the approaching convention. An interesting and instructive program is assured and the first vice-president, J. E. Guilford of Macon, is arranging the entertainment features. Among the speakers expected to address the association are: Ray Werner, State chemist of Georgia; A. M. Schoen of the Southeastern Underwriters Association; Rawson Collier of the Georgia Railway & Power Company of Atlanta; Dr. F. L. Parker, State chemist of South Carolina; H. Y. Carson, New York; A. J. Sproles, Greenwood; R. T. White of Columbia, and others. The association is offering two prizes—one is to be given to the member securing the largest number of new members, the other goes to the firm or manufacturer making the most attractive exhibit.

F. M. BERNARDIN

Frank M. Bernardin, president of the B.-R. Electric Company of Kansas City, was unanimously elected chairman of the central division of the Electrical Supply Jobbers' Association at Chicago on March 13. Mr. Bernardin has been a figure in the electrical industry at Kansas City since the first trolley cars were operated there. He started work with the Metropolitan Street Railway Company of Kansas City when it was organized in 1886, and before 1897 rose to the position of assistant general manager. In 1897 he organized the B.-R. Electric Company, which concern he has continued to head since that date. He has always been an active committee worker in the Electrical Supply Jobbers' Association, and is at present a member of that organization's executive committee. He has also shown active interest in local civic affairs, and was the organizer and first president of the Kansas City Electric Club.

S. J. Dill, for several years vice-president of the United Gas & Electric Engineering Corporation, will assume until further notice the duties which were performed by George B. Tripp, who resigned as a vice-president of the corporation on March 1 to become president of the Central Construction Company of Harrisburg, Pa. Mr. Dill went to New Orleans early in 1915 to assume charge of the work of the corporation in the South, returning a year later to New York. For a number of years Mr. Dill was connected with the Elmira (N. Y.) Water, Light & Railroad Company, of which company he became manager in 1908 and two years later vice-president and general manager.

A. C. Jordan has been appointed commercial manager of the Cumberland County Power & Light Company, of Portland, Me., succeeding George T. Fisher, who resigned on March 15 to enter business in New York City. Mr. Jordan is a graduate of the Massachusetts Institute of Technology and his experience includes a term of service in the plant of the Westinghouse Electric & Manufacturing Company, at East Pittsburgh, Pa., and central station work at Elmira, N. Y. Since joining the Portland company two years ago he has been in charge of power sales.

Men of the Industry

Changes in Personnel and Position— Biographical Notes

George Gibbs, who has been prominently identified with most of the more important railroad electrifications in the East, was elected president of the American Institute of Consulting Engineers at the recent council meeting. Mr. Gibbs was born on April 19, 1861, and received his engineering education at Stevens Institute of Technology, graduating in 1882. From 1884 to 1897 he was in the employ of the Chicago, Milwaukee & St. Paul Railway Company, being mechanical engineer of the system during the last ten years of his service. During the next four years he was consulting engineer for the Baldwin Locomotive Works and the Westinghouse Electric & Manufacturing Company. From 1901 to 1905 he was consulting engineer for the Interborough Rapid Transit Company. In 1904 he was employed by the West Jersey & Seashore Railroad as chief engineer of electric traction, serving for two years. During this time he was appointed a member of the board of engineers for the New York terminal of the Pennsylvania Railroad, his connection with the Pennsylvania system dating back to 1903, when he became chief engineer of electric traction and station construction of the Pennsylvania Tunnel & Terminal Railroad Company, which position he held until 1912. He was also

GEORGE GIBBS

chief engineer of electric traction of the Long Island Railroad. Among the organizations for which Mr. Gibbs has acted in a consulting capacity are the Norfolk & Western Railway, Pennsylvania Railroad, New York Connecting Railroad, Public Service Commission for the First District of New York and Chicago Commission on Smoke Abatement and Electrification of Railway Terminals. Mr. Gibbs is a member of the firm of Gibbs & Hill, New York City.

B. F. LYONS

B. F. Lyons, the president-elect of the Wisconsin Electrical Association, was graduated from the University of Wisconsin in 1903. Upon leaving school he became assistant engineer for the Laclede Gas Light Company of St. Louis. After three years he went into the employ of the Merchants Power Company of Memphis, Tenn., where he remained until 1907. At that time he took up his present work as vice-president and general manager of the Beloit (Wis.) Water, Gas & Electric Company. He has always been an active worker in State association work and is at the present time the president of the Wisconsin Gas Association.

Paul Augustinus, vice-president of the Marquette Electrical Engineering Company, Chicago, has been appointed a national director of the American Association of Engineers to succeed W. F. Mauer, resigned.

Willis M. Deming of Schenectady, N. Y., has resigned his position with the General Electric Company and will spend some time on the Pacific Coast in rest and recreation, for which he has long felt the need. He expects eventually to engage in business in that part of the country. Mr. Deming has been in the service of the General Electric Company for the last twenty-eight years, having entered the employ of the Thomson-Houston Company at West Lynn in 1888. On the evenings of March 8 and 13 he was tendered farewell dinners by his associates of the General Electric Company and other friends in Schenectady.

Obituary

Louis B. Sharpe, for eighteen years a superintendent of the Queensborough Gas & Electric Company died quite suddenly a few days ago at his home in Far Rockaway, N. Y., from a cerebral hemorrhage, at the age of forty-nine. Mr. Sharpe was connected with the electrical industry for about thirty years, being first employed by the Citizens Lighting Company, which was later absorbed by the Queensborough company, with which he was employed as superintendent until 1909, when he retired to enter the real estate field.

REVIEW OF TRADE AND MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

MARKET FOR ELECTRICAL GOODS STILL GROWING

Indications that Business for First Quarter of Current Year Will Be Greater than That for First Quarter of 1916

Electrical manufacturers continue to be swamped with business. At the present time there are evidences that the volume of unfilled orders exceeds that at the end of last year. December was one of the largest, if not the largest, month in the history of the industry up to that time, and then it was supposed that a good many orders were being placed prior to the new year so as to escape an expected advance in prices. January, however, it is understood, was even larger than December, and February, while not so large because of the smaller number of days, showed no diminution in weekly totals.

There seems to be good reasons to believe, therefore, that the first quarter of this year, which has one more week to run, will show a greater volume of business than the first quarter of 1916.

Electrical manufacturers have not the facilities to handle the great volume of business that is now being placed on the books in anything like normal times. At the rate orders are coming in it becomes evident that conditions must be getting worse instead of better. A number of new factories went up in 1916 and a number more are expected to be placed in operation during this year. The industry, therefore, will be in a position this year, unless the government intervenes, to turn out a greater volume of goods than was turned out in 1916, when the total was far in excess of $500,000,000. With prices generally higher for 1917 delivery than for 1916 delivery and with increased factory space it is not inconceivable that the value of the 1917 output will reach $750,000,000.

COPPER WIRE MARKET SHOWS CONTINUED LARGE DEMAND

Particular Activity Is Noticed in the Production of Both Code and Insulated Automobile Wire

Business has been large in the wire market and manufacturers are working at high speed. There has been a good demand for practically all kinds of wire and particularly code wire. This is house-wiring time and also marks the beginning of spring construction work. The manufacture of insulated wire for automobile purposes has reached a tremendous production and apparently is increasing all the time.

Local conditions as reported by correspondents of *The Wire Message*, published by the Habirshaw Electric Cable Company, Inc., and The Electric Cable Company follow:

San Francisco: General conditions good for 1917. Stock in bad shape owing to transportation difficulties. Lower prices and continued prosperity anticipated for this year. Business shows no falling off.

Los Angeles: Everything southern California has produced this year has been sold at record-breaking prices, and the yield has been large. Bank clearings show a heavy volume of business. More activity is manifest in real estate than for four years past. Banks are in condition to finance any legitimate enterprise.

Salt Lake City: Conditions are very good. Building is temporarily slack owing to weather conditions. Mines and smelters are working twenty-four hours.

Kansas City: The outlook for 1917 is good. There is considerable building activity regardless of prices, which are well maintained except by firms that cannot make good deliveries.

Atlanta: Expecting the biggest year in the history of Atlanta. Mills are running overtime; farmers have plenty of money. If we get enough cool weather to keep trees from budding too soon, the whole South will have a banner year.

DETAILED EXPORTS OF ELECTRICAL MANUFACTURES

Figures Are Arranged to Show Trade of the United States with Other Nations According to Customary Classification

There is presented on the next page a table showing in detail the exports of electrical goods of American manufacture to the different nations of the world under the customary government classification for the fiscal year ended June 30, 1916. The figures were compiled by the Bureau of Foreign and Domestic Commerce, and are shown here for the first time. The countries, it will be noticed, are grouped according to location.

LOW PRICE FOR COPPER TO THE ARMY AND NAVY

Agreement Reached by Producers to Take Care of the Government's Requirements at 16.67 Cents Per Pound

While it was generally understood that producers would take care of the copper needs of the Government at a price considerably below the present market, no concrete information came to light until this week, when it was announced that a price of 16.6739 cents a pound has been agreed upon by the producers as the price to the Government. This price, which is the average selling price for the past ten years, is about 20 cents under the present spot market price. During the coming year 20,000,000 lb. are to be furnished to the navy and around 25,500,000 lb. to the army at this price, representing a saving to the Government when compared with the spot market price of almost $10,000,000.

It is very doubtful if this cut to the Government will weaken the market, but it is more reasonable to expect that the market will be stronger than ever, and that higher prices will ultimately result. For a long time the market has been sluggish, although the high prices have been maintained. Prices early this week were practically the same as last week.

NEW YORK METAL MARKET PRICES

	Mar. 13 Selling Prices Bid	Mar. 13 Selling Prices Asked	Mar. 20 Selling Prices Bid	Mar. 20 Selling Prices Asked
Copper	£ s d		£ s d	
London, standard spot	136 0 0		136 0 0	
Prime Lake	35.00	to 36.00†	35.00	to 35.50†
Electrolytic	36.00	to 36.50†	35.50	to 36.00†
Casting	32.00	to 32.50†	31.25	to 31.75†
Copper wire base	42.50	to 43.50†	40.00	to 42.00†
Lead	9.00		9.00	
Nickel	50.00		50.00	
Sheet zinc, f.o.b. smelter	21.00		21.00	
Spelter, spot	10.82½	to 10.92½	10.55	to 10.80
Tin, straits	53.37½		55.50	
Aluminum, 98 to 99 per cent	53.00	to 55.00†	54.00	to 56.00

OLD METALS

Heavy copper and wire	28.50	to 29.50†	28.50	to 29.50†
Brass, heavy	17.50	to 18.00†	17.50	to 18.00†
Brass, light	14.25	to 14.75†	14.25	to 14.50†
Lead, heavy	8.00	to 8.50†	7.75	to 8.00†
Zinc, scrap	7.75	to 8.00†	7.50	to 7.75†

†Nominal.

Exports of Electrical Merchandise Manufactured in the United States for the Fiscal Year Ended June 30, 1916, Arranged Under Customary Government Classification According to Nations of Import.

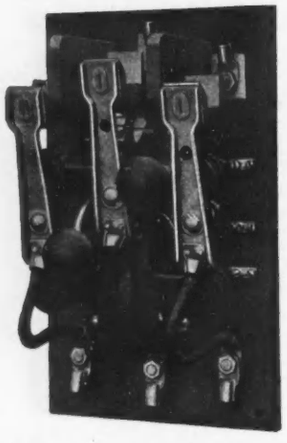
Country	Batteries	Dynamos or Generators	Fans	Insulated Wire and Cable	Interior Wiring Supplies, Including Fixtures	Arc Lamps	Carbon Filament Lamps	Metal Filament Lamps	Meters	Motors	Telegraph Instruments	Telephones	Transformers	All Others	Total
EUROPE:															
Austria-Hungary															
Azores and Madeira Is	$9	$305	$24		$25	$6		$377		$79				$155	$980
Belgium															
Denmark	5,453	188		$2,589	870			52	$5,205	4,881	$16,965	$1,722	$850	21,429	60,197
Finland	163	275		154									750	27,332	28,677
France	9,285	141,932	500	152,651	2,812		$3,034	40,429	9,123	333,628		34,971	50,597	592,106	1,371,065
Germany															
Gibraltar	48		25							35,380				37,445	72,898
Greece	486	52,722	1,805	465	1,594			1,124	138	527	444	193	112	84,846	144,457
Italy	12,922	66,586	16	47,256	28,067		5,022	12,320	30,990	146,703		137,176	84,443	920,350	1,481,853
Malta, Gozo, etc							14							65	65
Netherlands	8,652	12,387	80	95,037	1,157		201	1,419	667	17,754		6,818		53,588	197,769
Norway	14,875	545	726	318,286	226			4,742	545	21,292		1,133	10,595	687,196	1,060,261
Portugal	18	7,428		5,517	2,490	100	158	11,464	694	2,321		248	1,542	13,445	45,425
Roumania	42			15,073										1,344	16,459
Russia in Europe	9,987	76,638	217	13,915	13,112		17,695	114,899	40,184	614,404		299	77,915	452,301	1,431,566
Serbia, Montenegro, etc															
Spain	8,857	33,550	8	86,975	7,029	391	229	16,221	53,428	90,550	4,975	5,702	133,490	263,539	704,937
Sweden	537	1,168		1,276				269	1,868	711	210			31,449	37,488
Switzerland	52			2,571						400				12,345	15,369
Turkey in Europe															
United Kingdom:															
England	443,784	203,054	19,902	652,593	144,598		4,050	86,897	111,081	351,340	23,198	581,924	43,760	3,425,527	6,091,705
Scotland	14,082	936	187	11,020	282				256	28,907				63,622	119,293
Ireland					1,155				153	204				2,881	4,393
NORTH AMERICA:															
Bermuda	1,647	4	153	2,010	259			836	1,682	490		182	554	6,468	14,294
British Honduras	2,663	262	116	388	67		346	435	14	520		5		3,674	8,490
Canada	533,197	330,046	23,478	148,126	244,500	8,401	18,168	135,137	104,988	638,111	26,006	161,487	131,825	2,693,406	5,065,387
Central America:															
Costa Rica	2,177	3,289	117	7,746	2,225	152	5,389	5,392	201	5,309	1,978	1,968	6,254	26,082	68,271
Guatemala	894	7,859		3,988	401		1,290	1,276	210	2,397	231	475	4,177	11,612	34,810
Honduras	4,671	1,309	705	8,552	1,547	57	284	894	141	5,251	322	5,283	1,292	21,949	52,257
Nicaragua	2,948	511	137	310	314		285	1,666	60	1,106	1,982	625	5	15,496	26,444
Panama	27,437	17,335	3,696	235,926	14,332	802	1,799	4,956	13,645	102,397	3,597	10,957	50,007	211,862	462,824
Salvador	902	13,325	148	6,836	3,656		1,076	6,589	209	1,094		525	1,361	18,062	53,788
Mexico	27,649	8,776	6,573	58,398	8,148	230	13,729	86,136	14,366	48,877	41,174	20,347	17,408	313,962	665,767
Newfound. and Lab.	24,920			11,150	1,966		390	7,396	1,161	9,406	767	2,166	2,287	22,932	84,541
West Indies															
British:															
Barbadoes	738	57		218	262		93	221	28		882	156	40	1,412	4,101
Jamaica	4,951	418	261	1,419	2,959	49	99	904	1,204	3,088	2,651	733	359	7,580	26,684
Trin. and Tobago	1,876	641	401	1,392	362		198	1,481	689	1,059		828	637	8,047	17,611
Other British	1,627		232	606	407	88	27	702	351	415		575		2,598	7,629
Cuba	52,954	140,789	35,208	281,262	63,629	2,879	7,500	172,480	43,290	139,961	1,806	79,513	32,026	557,685	1,610,991
Danish	149		46	341	493		11	108	1,138	81		6		601	4,137
Dominican Repub.	2,783	3,100	250	6,552	3,894	282	146	3,059	516	1,057	12	2,145	68	14,381	38,246
Dutch	230		5	649	174		66	149	45	99		408	234	2,499	3,915
French	384	1,340	27	149	70			881		75		79		1,143	4,148
Haiti	327	62		1,674	561		10	452	712	225		1,656	445	4,305	10,430
SOUTH AMERICA:															
Argentina	51,489	10,475	62,816	140,146	18,051	584	11,276	82,101	75,110	54,163	2,455	5,658	13,185	412,450	921,908
Bolivia	306	904		4,924	347		314	1,550		2,106		164	35	10,152	20,802
Brazil	41,630	3,704	7,367	286,118	101,234	1,610	6,898	100,940	87,896	52,645	1,110	48,459	93,591	497,010	1,325,212
Chile	6,305	6,644	1,017	117,867	37,119	360	16,602	20,474	22,755	90,892	926	4,812	16,955	160,555	503,188
Colombia	7,268	40,751	1,344	22,509	7,416	164	2,178	16,524	1,905	26,302	1,160	11,039	11,703	62,154	212,417
Ecuador	3,568	747	979	2,912	2,702		1,604	4,842	1,109	3,704		11,022	761	21,336	53,783
Guiana (British, Dutch and French)	1,084	300	43	317	301	72	227	482	632	1,956	10	177	197	3,995	9,793
Peru	6,478	7,627	97	50,011	7,775	386	6,703	10,902	6,027	31,358	707	4,848	5,073	79,707	217,699
Uruguay	6,332	1,085	1,307	21,962	6,347	52	296	24,805	944	7,896	142	863	424	44,704	117,159
Venezuela	12,661	15,846	972	18,025	9,992	420	652	8,786	447	10,120	793	5,769	12,690	120,562	217,735
ASIA:															
China	14,065	46,989	17,506	20,215	6,756		4,680	67,285	5,053	43,480		15,685	7,317	159,002	408,033
China Leased Terr															
Japanese	75	1,624	50						483	48				7,074	9,354
Chosen	201	1,200		63				36	426	455		63		13,251	15,695
East Indies:															
British:															
British India	8,496	11,739	91,810	36,636	3,034	240	2,255	20,759	3,949	68,606		1,655	13,892	97,828	380,899
Straits Settlement	1,553	796	3,256		1,166		21	5,603		1,944				4,518	18,857
Other British	141	99	675	3,648				41				1,119	9,616	1,869	17,198
Dutch	4,898	5,294	698	79,873	369		2	380	2,461	9,126		3,135	256	61,059	117,551
Hong Kong	555	25,258	25,552		554		50	2,927	2,328	30,575			5,721	21,627	115,147
Japan	4,232	88,293	11,360	7,718	15,185	329		82	27,490	139,133	14	73,767	4,362	410,598	881,562
Russia in Asia	190	12,037		8,523	2,681		544	9,385	13,300	78,395		3,586		146,289	264,930
Siam	392	189	1,908	730	1,120		500	4,282		5,129		10	736	6,727	21,813
Turkey in Asia															
OCEANIA:															
British:															
Australia	86,345	24,336	21,366	66,360	28,992	78	6,297	91,708	61,965	685,596	1,254	61,979	70,192	549,882	1,756,355
New Zealand	31,835	1,251	973	2,028	1,469	356	118	5,630	3,821	54,340	5,761	1,209	10,161	132,716	251,658
Other British	532				21			942	71	167		25		1,777	4,135
French	3,260	379	39	548				135	66	70	89			3,989	8,575
German	316									514				349	1,179
Philippine Islands	8,964	32,252	6,631	45,332	7,133	584	664	20,938	6,984	50,787	6,910	12,689	2,953	177,109	379,930
AFRICA:															
British Africa:															
South	38,525	1,646	3,762	16,691	4,846		1,685	57,196	9,236	154,276		1,142	60,254	121,484	470,743
West	4				455					570				6,841	7,870
Egypt	268	358	40		3				2,701	2,124				1,280	6,774
East	58							150		66		94		855	1,223
Portuguese Africa	1,500	300	28	845				1,388	250	3,056		72		4,562	12,001
Total	$1,569,836	$1,468,961	$356,729	$3,157,239	$818,985	$18,693	$144,872	$1,282,039	$776,381	$4,218,974	$148,536	$1,329,346	$993,193	$13,972,944	$30,256,728

NEW APPARATUS AND APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Remote-Control Switches

Remote-control switches are being made in single, double and triple-pole types by the Cutler-Hammer Manufacturing Company of Milwaukee, a triple pole type being shown herewith. The design is such that energy is consumed only on opening and closing, a mechanical latch holding the contacts closed after the switch contacts are closed by magnetic force. The same type of contact fingers is used as on other control apparatus made by this company. The contacts are made of cold-rolled copper and are kept clean by a wiping motion produced during operation. Two solenoids are used, one for closing and the



TRIPLE POLE REMOTE-CONTROL SWITCH

other for opening the switch. They are energized by circuits connected to push-button control switches which may be placed where desired. The new switches are of 100 amp. capacity and are made for both alternating and direct-current circuits. They are particularly adapted to the control of lighting circuits from a distant point or central location.

Automatic Printing Press Controllers

The Industrial Controller Company of Milwaukee has recently developed a new line of automatic controllers, designed particularly for printing press service. The accompanying illustration shows one of the several automatic printing press controllers brought out. The controller has an automatic starting movement of the same construction used in the type E controller which is largely used for industrial purposes, and a hand-set speed regulator mounted on the same panel with the automatic movement.

Speed regulation is accomplished manually, speed below normal being obtained by inserting resistance in the armature circuit and speed above normal by inserting resistance in the shunt

FIG. 1—PUSH-BUTTON SWITCHES

field. The standard controllers are designed for 40 per cent speed reduction and 100 per cent speed increase. Full field strength during starting is secured by means of a vibrating field relay mounted on the panel. A dynamic brake is also provided for rapid stopping of the press. The controllers designed for wall mounting have the automatic starting mechanism at the top, and the speed regulating lever below, thus permitting the controller to be mounted fairly high, and allowing convenient access to the starting lever.

The speed regulating lever may be set to give any desired speed to the press. Push buttons mounted on, or near, the press are used to stop and start the motor, always bringing it up to the predetermined speed at which the regulating lever has been set. The time of acceleration is adjustable by means of

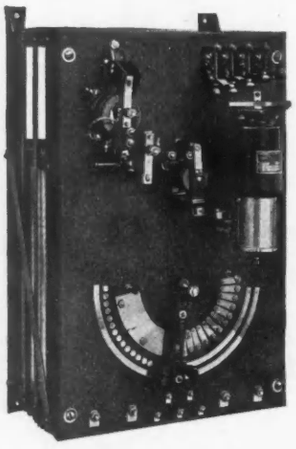
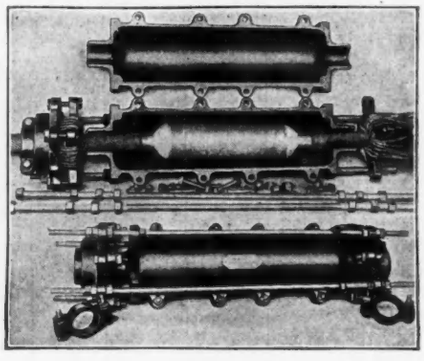


FIG. 2—AUTOMATIC CONTROLLER FOR PRINTING PRESSES

needle valves in the dash pot of the automatic movement. Any of the numerous types of standard I-C push buttons may be used with this controller. By these buttons the press may be started, stopped, "inched," run at extra low speed for make-ready, or reversed. Several stations are often furnished for each press, and buttons are also supplied with a lockout feature so that when the press is stopped at one station and locked out, it cannot be started from any other station until the lockout button is released.

Housing for Submarine Cables

An improved type of joint box or housing for use on submarine cables has recently been developed and perfected by the Standard Underground Cable Company. The box is designed



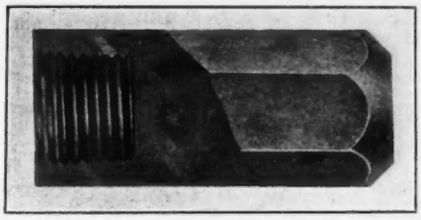
CONSTRUCTION OF HOUSING FOR USE ON SUBMARINE CABLES

so that all mechanical stresses resulting from the action of tides, currents, etc., that usually tend to damage cable joints are transmitted past the joint by long "take-up" rods running parallel to the joint box and are rigidly connected to the steel-wire armor on each side of the joint by heavy iron clamps. This construction is clearly shown in the accompanying illustration. As submarine cables, even under normal conditions, are subjected to severe mechanical stresses and have heretofore often failed first at the joints, this new device, which so far has proved very effective, offers a solution for a serious problem in submarine cable laying.

The boxes are being used on submarine cables supplied to the Atlantic City Electric Company for the U. S. Ship Canal at Atlantic City, and to the Wilmington & Philadelphia Traction Company and the Pennsgrove Light, Heat and Power Company for crossing the Delaware River at Wilmington, Del. It was also used in Canada on submarine cables of the Halifax Electric Tramway Company and the City of Ottawa Water Works Department.

Drive Head for Installing Ground Pipes

The Fargo Manufacturing Company of Poughkeepsie, N. Y., has developed a drive head made of cold-rolled steel



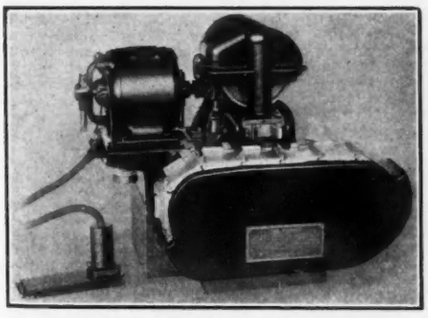
DRIVE HEAD THAT PROTECTS PIPE THREAD

which is used to protect the thread on pipe when it is being driven into the earth for making grounds and the like. When the ground pipe is driven the required depth the driver head can be removed and a ground cap screwed in place, thus making a ground connection that can be easily and cheaply installed, and tested as often as desired.

Motor-Driven Tag Marker

Shown herewith is a motor-driven tag marker, manufactured by the H. G. Davis Manufacturing Company, 4131 Frankford Avenue, Philadelphia, Pa., which has a capacity of printing 2400 tags in one hour. The mechanism of this tag marker, which is driven by a 1/20 hp. Westinghouse motor through a worm and gear, consists of a set of cams which move an endless chain of aluminum trays beneath a miniature-type chase. The tags are printed as they move along on these trays. The trays are hand fed. A tag is placed in each tray beneath a clip which holds the tag in place from the time it is fed into the machine until marked by a downward movement of the type chase. This arrangement insures uniform register of the marking. When the tag is printed it is automatically released from the clip and discharged from the tray at the end of the machine.

The machine will accommodate any size or shape of tag up to 1.75 in. wide, of any thickness from thin paper up to



MARKER THAT PRINTS 2400 TAGS IN AN HOUR

cards 3/32 in. thick. The type chase is adjustable so that it can be adapted to various sizes of type and can be used to mark as many as seven lines with fifteen small characters or nine large characters on a line. The type commonly used is of metal (full 12 point, 1/6 in. high). With the usual set-up of the chase, it is possible to print both the tag and the stub with the words, Lot, Size, Price and some other word if needed.

This tag marker is compact, portable, very quiet in operation, due to the worm drive, and weighs 45 lb. It is furnished complete with a type drawer conveniently arranged at the back of the machine, and is finished in black japanned enamel. All gears and mechanism are thoroughly protected. The motor leads are brought out through cord and plug for attachment to any lamp socket. In addition, a foot switch is provided by which the operation of the machine is controlled.

Safety Panel Cut-Out

A panel cut-out, which is said by its manufacturer, to combine the simplicity of the porcelain cut-out with the finished appearance of a busbar type of

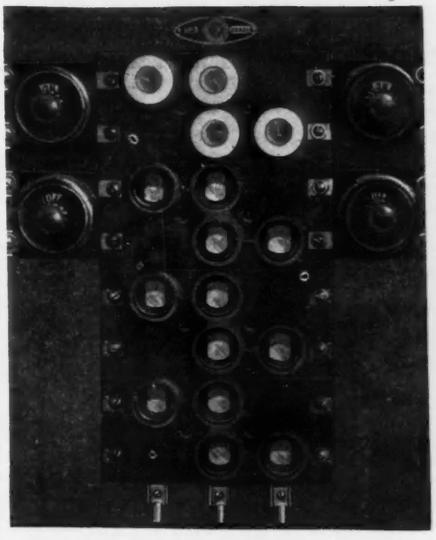


FIG. 1—PANEL CARRYING EIGHT CIRCUITS

panel has been developed by the Chicago Fuse Manufacturing Company.

The cut-out does away with the many exposed live parts and the possibility of poor contact between copper parts. The method of installing it is shown in the accompanying illustration, which represents a panel carrying eight circuits, four with switches and four without switches. On the panel are mounted three busbars over which are mounted the safety cut-outs, each being firmly attached to the panel by two screws. Three grooves in the base of the cut-out which measure ⅛ in. deep by 1 1/32 in. wide, are provided to admit the busbars between the panel and the cut-out. These grooves are separated by the required 0.75-in. space. When the fuse plugs are screwed into the cut-outs they make firm contact with the busbars. All connections between the shells and the terminals are embedded in the body of the cut-out and are completely concealed. The cut-out block itself is made from an approved composition with high mechanical and dielectric strength. It will withstand a temperature of 400 deg. Fahr, without injury, it is claimed.

The advantages of this safety panel cut-out, as set forth by its manufacturer, are that it is practically indestructible, that it has a dead-front feature,

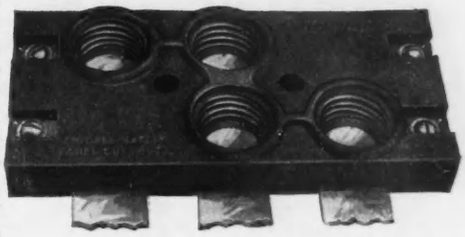


FIG. 2—SECTION OF SAFETY PANEL

that it has the approval of the Underwriters' Laboratories, that it has high dielectric strength and great heat resisting qualities, that it is simple and can be quickly built up for any number of circuits, that it has a neat and finished appearance, that it requires a minimum amount of cabinet space, that circuits can be easily added and that it is inexpensive.

Small Electric Soldering Iron

A small electric soldering iron designed with a tip which is easily removable, and which can be extended at various lengths both for special use or as the tip is melted down, has been developed by the Frank B. Cook Company, 326 West Madison Street, Chicago, Ill. The heating element is wound on a steel shell, well insulated with mica. One end of the tip is designed to be placed inside the steel shell. The heating element itself is easily removable for repair or renewal. The end of the handle can be unscrewed and the iron partly telescoped to permit the removal or renewal of the cord. This iron is

CONSTRUCTION OF SMALL ELECTRIC SOLDERING IRON

rated at 95 watts, its weight is 13 oz., the length 14 in., and the diameter of tip 0.5. The company also makes other irons, which weigh 10 oz., 15 oz. and 13 oz., and have tip diameters of 0.5 in., 0.75 in. and 1⅛ in., respectively.

Trade Notes

NEW MANUFACTURERS' AGENCY AT CHICAGO. — The business of W. J. Doherty, at 618 West Jackson Boulevard, Chicago, has been incorporated and will be conducted under the new name of the Doherty-Hafner Company, at the present address. Henry G. Hafner, who joins Mr. Doherty in the new corporation, has been connected with the Central Electric Company for the last ten years. The concerns which this agency will represent are: Stanley & Patterson, New York City; V. V. Fittings Company, Philadelphia; McGill Manufacturing Company, Valparaiso, Ind.; Eck Dynamo Motor Company, Belleville, N. J.; Thomas & Betts Company, New York City; Central Tube Company, Pittsburgh, Pa., and A. B. Wilson Company, Cleveland, Ohio.

ERNEST F. LEARNED has joined the staff of the Day-Baker Motor Truck Company and will devote himself to the sale of the Hunt industrial electric truck, with headquarters at 110 State Street, Boston, Mass. Mr. Learned was formerly employed by the Stone & Webster Engineering Corporation of Boston, and has had an extensive experience in the fields of hydroelectric power and transportation development.

P. & B. MANUFACTURING COMPANY, Milwaukee, Wis., has increased its capital stock from $25,000 to $50,000. It is now building a new plant, which will be completed by May 1.

SOUTHWEST GENERAL ELECTRIC COMPANY will move its Oklahoma City branch office from 402 Insurance Building to 301-302 Terminal Building.

POST & LESTER COMPANY, Hartford, Conn., in order to more readily supply the requirements of the automobile trade and extending service to automobile users throughout New England, has recently been appointed distributer of S K F ball bearings. With branch houses in Boston, Bridgeport, New Haven, New London, Providence, Springfield, Waterbury and Worcester, the Post & Lester Company will be able to supply S K F radial and thrust bearings from stock.

FOX METAL MANUFACTURING CORPORATION, 295 Fifth Avenue, New York, N. Y., which was recently organized, has the patent and manufacturing rights of the Jules folding and portable lamp. In addition the new company will manufacture other metal products, principally electrical. William H. Vidor is president of the new company and Baret Bernstein is secretary and treasurer.

E-H ELECTRIC COMPANY, 1405 Brush Street, San Francisco, Cal., is now doing business under the name of Electric Signal Company, 1307 Sutter Street, San Francisco.

STANDARD UNDERGROUND CABLE COMPANY OF CANADA, LTD., in preparation for the prosperous times which the company anticipates will prevail after the close of the war, is making an addition to its factory at Hamilton, Ont., which when completed and equipped with the necessary machinery will represent an investment of $50,000. The new structure, which consists of one story with basement, built of brick and concrete, and is 125 x 120 ft. in dimensions, giving a total increase in floor space of 30,000 sq. ft., will be devoted exclusively to the uses of the wire drawing department, and in addition to housing the former equipment will contain material additions of new machinery.

CROCKER-WHEELER COMPANY in its February statement shows an increase in surplus of about 7 per cent, bringing the total surplus to more than $850,000. The net earnings broke the record for February, a short month, being greater than in any February since the founding of the company twenty-eight years ago. It is further stated that the bookings continue good and represent straight electrical business, as the company has returned to the exclusive manufacture of electrical equipment. However, it was announced that the company stood ready to re-enter the munition business if called upon by the United States government, as it has, in addition to the equipment, the trained men necessary for the work. The common stock of the company continues on a permanent 8 per cent per annum basis, with the preferred yielding 7 per cent.

WILLIAM E. COPELAND, for the past several years in charge of the New Orleans office of the Westinghouse Lamp Company, has been transferred to the New York office and in the future will have charge of the company's sales in the uptown district of Manhattan.

COOPER HEWITT ELECTRIC COMPANY recently held a salesmen's meeting at the factory in Hoboken, N. J. Representatives were present from the Boston, Philadelphia, Pittsburgh, Cleveland, Detroit, St. Louis and Cincinnati offices.

RAMEY MANUFACTURING COMPANY, Chillicothe, Ohio, manufacturer of the Simplex vacuum cleaner, has recently moved its factory to 45 South Wall Street, Columbus, Ohio. The factory has a capacity of sixty machines per day.

GEORGE C. KNOTT has resigned as sales and advertising manager of the Wirt Company, Philadelphia, and formed a partnership with George L. Hatheway. The new company will be known as Hatheway & Knott, with offices at 120 Liberty Street, New York, and will engage in the distribution of products of various electrical manufacturers. Mr. Knott was for many years associated with the Benjamin Electric Manufacturing Company, and Mr. Hatheway was formerly with Pass & Seymour. For the entire United States, they will act as general sales agents for R. M. C. conduit fittings, etc., and Eade chain insulators; in New York and Eastern territory, the Wirt Dim-a-lites, Killark Electric Manufacturing Company products and others. They will also maintain a Canadian connection, representing throughout the dominion the following concerns: Manhattan Electrical Supply Company, Steel City Electric Company, Killark Electric Manufacturing Company, Capital Porcelain Manufacturing Company, Eastern Flexible Conduit Company, National Electric Porcelain Company.

Trade Publications

TELEPHONE PROTECTIVE APPARATUS.—The Frank B. Cook Company, 326 West Madison Street, Chicago, Ill., has issued a catalog descriptive of its telephone protective apparatus and supplies. Several new central office protectors are listed, and a new lightning arrester. A discount sheet, which is now in effect, is found on the inside back cover.

ELECTRICIANS' BITS.—The W. A. Ives Manufacturing Company, Wallingford, Conn., has prepared a booklet descriptive of its "Mephisto" bits.

LUMINOUS COMPOUND. — "Marvelite" a new luminous compound made with radium is described in the bulletin recently issued by the Cold Lighht Manufacturing Company of Denver, Col.

LAMPS.—The Franklin Electric Company of Hartford, Conn., has prepared an illustrated folder descriptive of Franklin Mazda lamps.

CHAINS.—The Link-Belt Company of Chicago has prepared bulletin No. 282, descriptive of Link-Belt silent chain transmitting power in the dye-making industry.

POWER DUMP.—The Taylor power dump is carefully described and illustrated in a bulletin recently issued by the American Engineering Company of Philadelphia, Pa.

BALL BEARINGS.—The Gurney Ball Bearing Company of Jamestown, N. Y., is distributing a bulletin entitled "Bearing on Bearings."

BALL BEARINGS.—The Hess-Bright Manufacturing Company of Philadelphia, Pa., is distributing an illustrated bulletin descriptive of ball bearings in machine tools.

RAILWAY APPARATUS.—"Steam Road Electrifications" is the title of a well-illustrated and prepared bulletin that has been issued by the Ohio Brass Company of Mansfield, Ohio.

REFLECTORS.—The National X-Ray Reflector Company of 235 West Jackson Boulevard, Chicago, Ill., is distributing its February issue of *Eye Comfort*.

MOTOR GENERATORS.—Hobart Brothers Company, Troy, Ohio, has prepared an illustrated leaflet descriptive of its battery charging outfits.

OIL TANKS.—The Wayne Oil Tank & Pump Company of Fort Wayne, Ind., has prepared an illustrated leaflet descriptive of its oil tanks and pumps.

STORAGE BATTERIES.—The General Lead Batteries Company of Newark, N. J., is distributing bulletin No. 20, descriptive of its Titan grid batteries for electric vehicles.

MOTORS.—"A Modern Lumber Mill" is the title of bulletin No. 114 now being distributed by the Wagner Electric Manufacturing Company of St. Louis, Mo. This bulletin describes the electrical and mechanical equipment.

New Incorporations

THE LAUDERDALE LIGHT & POWER COMPANY of Ripley, Tenn., has been incorporated with a capital stock of $20,000 to build and operate a light and power plant. The incorporators are: W. W. Craig, E. C. Bullock, J. M. Carney and G. M. Pirtle.

THE COAL DISTRICT POWER COMPANY of Fort Smith, Ark., has been chartered by L. A. Petit, Jr., L. E. Turner, G. W. Skow, Hugh Means and Albert Emanuel. The company is capitalized at $120,000 and proposes to generate and distribute electricity for lamps, heaters and motors.

THE STANDARD LAMP & SHADE COMPANY of Brooklyn, N. Y., has been incorporated by S. A. Tesley, B. Popkin and L. Brook, 171 Hewes Street, Brooklyn, N. Y. The company is capitalized at $5,000 and proposes to manufacture gas and electric lamps, fixtures, shades, etc.

THE RIVERIA CONSTRUCTION CORPORATION of Brooklyn, N. Y., has been incorporated by R. C. Lipman, J. J. Alexander and W. F. Murphy, 292 St. John's Place, Brooklyn, N. Y. The incorporators are: R. C. Lipman, J. J. Alexander and W. F. Murphy, 292 St. John's Place, Brooklyn, N. Y.

THE MATEWAN (W. Va.) LIGHT & POWER COMPANY has been incorporated with a capital stock of $25,000 by C. M. Gates, W. O. Hay and C. R. Gates of Sprigg; G. T. Blankenship and G. T. Blankenship, Jr., of Matewan, W. Va.

THE BELLEVILLE (W. Va.) ELECTRIC COMPANY has been incorporated by Harrison A. Smith, K. B. Smith and W. G. Kerchoffer, all of Madison.

THE CENTRAL OKLAHOMA LIGHT & POWER COMPANY of Oklahoma City, Okla., has been chartered with a capital stock of $25,000 by George M. Green, H. L. McCracken and L. Smilie.

THE SHINNSTON (W. Va.) POWER & LIGHT COMPANY has been incorporated by Aura R. Walls, John B. Wyatt, M. A. Wells and others. The company is capitalized at $15,000.

THE COLUMBIA POWER COMPANY of Lexington, N. C., has been incorporated with a capital stock of $100,000 by Dermot Shemwell, J. E. Foy and I. L. Sink, all of Lexington, N. C.

THE BATAVIA (Ohio) LIGHT & POWER COMPANY has been chartered with a capital stock of $10,000 by Allen B. Nichols, Eli H. Speidel, Percy F. Jamieson, M. J. Kain and H. F. Buerkle.

THE LIQUID RECORDING INSTRUMENT COMPANY of New York, N. Y., has been incorporated, with a capital stock of $5,000, to manufacture and deal in electrical and mechanical machinery, apparatus, devices, etc. The incorporators are: C. Hoffer, J. D. Clay and C. S. Harris, 101 West Twelfth Street, New York City.

THE AMERICAN AUSOPHONE COMPANY of New York, N. Y., has been granted a charter, with a capital stock of $1,000,000, to manufacture machines for receiving and transmitting telephonic and telegraphic messages. The incorporators are: Samuel B. Howard, Harry B. Davis and Arthur W. Britton of New York, N. Y.

THE CHEMICAL ENGINEERING & RESEARCH CORPORATION of New York, N. Y., has filed articles of incorporation for the purpose of giving expert service and advice on mechanical, engineering, chemical, electric or other problems. The incorporators are: B. L. Walter, A. J. Brett and George Rosendale.

THE BATTERY EQUIPMENT & STORAGE COMPANY of Houston, Tex., has been chartered with a capital stock of $10,000 by S. M. Griffin, H. M. Harbin and R. C. Patterson.

THE CONSOLIDATED RADIO LABORATORIES of New York, N. Y., has been incorporated by J. F. Grinan, A. J. Faraon and William Biel. The company is capitalized at $2,000 and proposes to make technical experiments in wireless.

FRED W. L. FULLERTON, INC., of New York, N. Y., has filed articles of incorporation, with a capital stock of $10,000, to do a general electrical and mechanical engineering business and also electrical work. The incorporators are: M. J. Doran, T. R. Blake, F. W. L. Fullerton of South Orange, N. J.

THE WILLIAM C. KRAUTH ELECTRIC COMPANY of Louisville, Ky., has been chartered, with a capital stock of $3,000, by William C. Krauth, Edwin W. and Herman F. Andres.

New England

CONTOOCOOK, N. H.—The plant of the Contoocook Electric Light Company is now being reconstructed. I. L. Meloon is president and manager.

PORTSMOUTH, N. H.—The Rockingham County Light & Power Company is installing two 600-hp. Babcock & Wilcox boilers one 1000-kw. General Electric 60-cycle turbine and new switchboard. Orders have been placed for two 600-hp. Babcock & Wilcox boilers and one 2500-kw. General Electric 60-cycle turbine. F. A. Belden is manager.

BROOKLINE, MASS.—Plans are being considered by the New England Fireproof Construction Company for the installation of an electric plant. G. B. Washburn, 6 Beacon Street, Boston, is architect..

WORCESTER, MASS.—Extensions to the ornamental street-lighting system are under consideration by the City Council.

NEW HAVEN, CONN.—Contract has been awarded by the United Illuminating Company for the erection of a substation 26 ft. by 54 ft., to be erected at 201 George Street, New Haven.

Middle Atlantic

AKRON, N. Y.—The bill passed by the State Legislature legalizing the bond issue of $19,000 for a municipal electric-light plant and street-lighting system in Akron has been signed by Governor Whitman.

BUFFALO, N. Y.—Contract has been awarded by the Lehigh Valley Railroad Company, 143 Liberty Street, New York City, to the Westinghouse, Church, Kerr Company, 37 Wall Street, New York City, for the construction of an engine house at East Buffalo, a 15-stall addition to the engine house at Tifft Farm, together with new machine shops, power house, etc. The size of the present boiler plant will be trebled. Later on a mechanical coaling plant will be added. Wherever possible electrically operated machinery will be installed in the engine house.

ELMHURST, N. Y.—The New York Telephone Company is planning to erect a three-story telephone exchange on Broadway to cost about $75,000.

HEMPSTEAD, N. Y.—The installation of a municipal electric-light plant in connection with the waterworks plant is under consideration by the Village Board.

MONTICELLO, N. Y.—The Murray Electric Light & Power Company of Monticello has contracted with the Port Jervis (N. Y.) Light & Power Company for energy to operate its system. The local power house will be closed down.

NEW YORK, N. Y.—Bids will be received by the Departments of Docks and Ferries, Fire and Water Supply, Gas and Electricity, at the office of the Central Purchasing Committee, Room 1220, Municipal Building, New York City, until March 29 for furnishing electrical fittings and supplies. The time of the performance of the contract is on or before Dec. 31, 1917.

NEW YORK, N. Y.—The city of New York, Department of Correction, is planning to erect an industrial building at New Hampton, N. Y., to cost about $75,000; also a power house, laundry and stores, one story and basement, to cost about $161,585. Burdette G. Lewis, Municipal Building, is commissioner of corrections. C. B. Myers, 1 Union Square, is architect.

NEW YORK, N. Y.—Bids will be received by the Board of Trustees or the Curator of the College of the City of New York, Room 114, Main Building, 139th Street and Convent Avenue, New York City, until March 28 for furnishing labor and materials necessary and required for (estimate A) alterations and repairs, including the installation of electric-lighting and fire-alarm systems; (estimate B) the restoration of the exterior brick and stone work of the Twenty-third Street Building of the College of the City of New York, Lexington Avenue and Twenty-third Street. Bids will be received for the entire work; also separate bids for estimates A and B.

PULASKI, N. Y.—The Salmon River Power Company, which operates a hydro-electric power plant at Orwell, has applied to the Public Service Commission for permission to take over the plant and holdings of the Pulaski Electric Light Company.

ROOSEVELT, N. Y.—The establishment of a municipal electric-light plant in Roosevelt is under consideration.

WELLSVILLE, N. Y.—The Water and Light Department is replacing the gas street lamps with 7.5-amp. series electric lamps as rapidly as the electric distribution lines are extended. J. M. Sill is superintendent.

WHITNEY POINT, N. Y. — The Union Electric Company contemplates building a new concrete dam about July, 1917, and changing its system from 133 to 60 cycles. D. O'Connell is president and manager.

CHESTER, PA.—Bids will be received by John H. Mirkil, superintendent of parks and public property, until April 16, for construction of a new city hall; separate bids to be submitted for electrical work, heating and plumbing.

GREENVILLE, PA.—The contract for electrical work for the new Penn High School has been awarded to the Queen City Garage & Electric Company of Titusville, at $5,600.

LANSFORD, PA.—The Lansford Electric Light Company has been granted the right to erect a high-tension transmission line through Lansford to connect with its new substation recently completed.

PHILADELPHIA, PA.—The C. H. Wheeler Manufacturing Company contemplates the construction of a boiler and engine house addition to its plant at Eighteenth Street and Lehigh Avenue.

PHILADELPHIA, PA.—The Bell Telephone Company is planning to build a new branch telephone station on West Chelton Avenue, Germantown, to cost about $400,000. Plant equipment and improvements to local system for connection with the new exchange are estimated at $180,000.

PHILADELPHIA, PA.—Bids will be received by the Bureau of Surveys, Department of Public Works, Room 412, City Hall, Philadelphia, until April 10 for construction of concrete grit chamber with inlet and outlet sewers and superstructure, including machinery and equipment, electric wiring and fixtures, heating and incinerator, ventilating and plumbing.

PITTSBURGH, PA.—The power plant of the Westinghouse Electric & Manufacturing Company at East Pittsburgh was recently destroyed by fire.

POTTSVILLE, PA.—The contract for street-lighting has been awarded to the Eastern Pennsylvania Light, Heat & Power Company, under which provision is made for the installation of an ornamental lighting system in the business district.

QUAKERTOWN, PA. — The city of Quakertown has purchased a site for a new power plant and proposes to install new equipment, including engines, generators, boilers, etc. G. E. Willard is superintendent.

SCRANTON, PA.—The Scranton & Binghamton Electric Railway Company is contemplating erecting a 66,000-volt electric transmission line from the present terminal in Tiany to Binghamton during the present year.

SHARON, PA.—The Shenango Valley Electric Light Company is planning to make additions to its substation on Silver Street, for which additional space has been acquired. The company, it is stated, will arrange to carry the high-tension lines when the new transmission line from Lowellville to Masury is erected.

SIEGFRIED (NORTHAMPTON P. O.), PA.—The Lawrence Portland Cement Company is equipping its plant at Siegfried for electrical operation at a cost of about $250,000. Energy will be obtained from the transmission system of the Lehigh Navigation Electric Company of Hauto.

TELFORD, PA.—The Excelsior Electric Light & Power Company of Sellersville has submitted a proposal to the Borough Council offering to replace the arc lamps now in use with tungsten lamps. Harold M. Hamel of Sellersville is general superintendent.

NEWARK, N. J.—The Central Dyestuff & Chemical Company is planning to erect a transformer house, 17 ft. by 25 ft., at its plant on Plum Point Lane.

NEWARK, N. J.—Plans have been prepared by the Board of Works for a garbage incinerator plant, to cost about $538,000. Investigations are now under way to build a municipal electric plant in conjunction with the proposed garbage plant, to cost approximately $350,000 additional. Morris R. Sherrerd is chief engineer.

NEWTON, N. J.—The property of the Newton Gas & Electric Company has been acquired by the National Utilities Company of Boston, Mass. The new company will make extensions and improvements to the local plant and system.

WASHINGTON, N. J.—The Council is considering a bid submitted by the Washington Electric Company for street lighting, which provides for the installation of new tungsten lamps equipped with reflector refractors, throughout the city. Lamps of 250 cp. will be installed in the business section and 100-cp. lamps on other thoroughfares.

WASHINGTON, D. C.—Bids will be received at the office of the chief signal officer, War Department, Washington, D. C., until April 2, under proposal 935, for furnishing camp telephones and service buzzers in lots of 500, 1000 and 2000. For further information address Major Charles S. Wallace.

WASHINGTON, D. C.—Bids will be received at the office of the Commissioners of District of Columbia, Washington, D. C., until April 3, for furnishing during the fiscal year beginning July 1, 1917, and ending June 30, 1918, for use of the various branches of the government of the District of Columbia electrical supplies, etc. Further information may be obtained from the purchasing officer, Room 320, District Building, Washington, D. C.

North Central

MANISTIQUE, MICH.—Work on excavation has begun for the proposed paper and pulp mill, to cost about $1,000,000, for the Manistique Light & Power Company. J. C. Jacobson, Security Building, Minneapolis, is mechanical and structural engineer.

ST. LOUIS, MICH.—A petition has been presented to the City Council asking that steps be taken to learn the feasibility of acquiring water rights on the river below St. Louis and the erection of a dam and power plant to supply additional power for the city.

WEST BRANCH, MICH.—The Northern Power Company will install two new high-speed Leffel water wheels of combined rating of 166 hp. during the coming summer. J. J. Thorne of Bay City is owner.

ATHENS, OHIO.—The removal of the hospital power plant to a new location in connection with the construction of a railroad spur to handle fuel is under consideration by the board of administration of the Athens State Hospital. The present plant is old and in need of repairs.

BATAVIA, OHIO.—The Village Council expects to purchase energy to operate the municipal electric-light plant by July 1, 1917, from the Batavia Light & Power Company, which was organized to purchase power from the Cincinnati, Georgetown & Portsmouth Railroad Company and sell it to the village. The proposed new equipment will include one 120-kva., three-phase, 60-cycle, 2200-volt generator directly connected to a 200-hp., three-phase, 25-cycle, 440-volt motor and four 40-kva., 16,500/440-volt transformers. N. B. Dennison is secretary.

BLUFFTON, OHIO.—At an election held March 6 bonds to the amount of $35,000 for improvements to the municipal electric-light plant were authorized.

CINCINNATI, OHIO.—The installation of ornamental lamps on McMillan Street and on Gilbert Avenue is under consideration. Service Director Hornberger has been requested to submit an estimate of cost to the City Council.

CINCINNATI, OHIO.—The board of education is asking for bids for the completion of the vacuum cleaning system to be installed in the Madisonville high and elementary schools and in the Cummins Public School. Plans and specifications are on file in the office of C. W. Handman, business manager of the board.

CLEVELAND, OHIO.—Plans have been filed by the Cleveland Electric Illuminating Company for the erection of a substation, 50 ft. by 69 ft., at 817 East 103d Street, to cost about $35,000.

DAYTON, OHIO.—Permit has been granted to the Dayton Power & Light Company for the erection of a large power house at Millers Ford, to cost about $510,000.

ELMWOOD PLACE, OHIO.—The Village Council has voted to contract with the Union Gas & Electric Company of Cincinnati to replace the 60 gas lamps now in use with electric lamps.

ELYRIA, OHIO.—Work will soon begin on the erection of an addition to the Memorial Hospital and the construction of power plant and laundry, to cost about $85,000. Contract for erection of building has been awarded to L. A. Burgett & Son of Lorain and for heating system to J. A. Lucas.

FAIRPORT, OHIO.—The Sunnyside Electric Company is planning to erect an electric transmission line from Fairport to Flushing, a distance of 9 miles.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

FREMONT, OHIO. — Arrangements are being made by the Ohio State Power Company for the construction of an addition to its power plant at Ballville to provide space for the installation of additional transformers to increase the output of the station to supply electricity in Shelby, where the company has secured a franchise.

GREENWICH, OHIO. — The town of Greenwich is contemplating improvements to the water and lighting plant, to cost about $20,000. The work will include excavating reservoir, enlarging suction pipe, purchasing new pump, lowering pumps 6 feet, building addition to power house, etc. F. H. Daniels is clerk.

MARION, OHIO.—In connection with the reorganization of the Columbus, Delaware & Marion Railway Company and its allied properties, represented by Joseph B. Foraker of Cincinnati, it is stated that Frank G. Glosser of Marion, superintendent of the Marion lighting department, has submitted recommendations for a large power plant, to be erected as soon as the receivership is lifted and reorganization effected. Mr. Glosser, it is reported, suggests that the power station be located at Newman's, 8 miles south of Marion. The cost of the proposed plant is estimated at $90,000.

MASSILLON, OHIO.—Arrangements are being made by the Massillon Electric & Gas Company for the installation of a new street-lighting system. Work will begin about May 1.

NELSONVILLE, OHIO.—A large amount of electrical equipment, it is reported, will be required by C. C. Sharp, head of a company organized to develop 800 acres of coal land. Energy will be furnished by the Hocking Power Company of Nelsonville.

ST. MARY'S, OHIO.—Improvements are contemplated to the municipal electric-light and water plant, involving an expenditure of about $61,000. C. L. Selby is superintendent.

ST. MARY'S, OHIO.—The Western Ohio Railroad Company is installing a new 4000-kw. General Electric, 25-cycle, 2200-volt turbine in its local plant, which will be ready for service about July 1.

LEBANON, KY.—The Lebanon Light, Ice & Power Company, it is reported, contemplates the installation of a new generator.

EDWARDSPORT, IND.—Preparations, it is reported, are being made by the Indiana Power & Water Company of Bloomfield to erect a power plant, 120 ft. by 150 ft. in Edwardsport.

FORT WAYNE, IND.—Bids will be received by the Board of Public Works of the City of Fort Wayne, until March 27, for furnishing and installing one steam boiler having a rating from 725 to 750 hp., with automatic stoker engine for the municipal electric-light plant. Bids will also be received on the same date for furnishing and installing one 3000-kw. steam turbine generator and surface condenser with auxiliary equipment. H. W. Becker is clerk.

GARY, IND.—Plans have been comp'eted for an electric substation, 40 ft. by 40 ft., for the Gary Heat, Light & Water Company, to cost about $12,000. A. F. Wicks is architect.

GRIFFIN, IND.—Bonds have been authorized for the construction of a municipal electric-light plant.

NAPANEE, IND.—Declining to accept the offer of the Hawks Electric Company of Goshen to purchase the municipal electric-light plant, the Town Board is considering a plan to sell the plant to a corporation in which the town will be the controlling stockholder. As the town's indebtedness has reached the legal limit the trustees have taken this way of securing funds to make necessary improvements.

STROH, IND.—Arrangements have been made for the installation of an electric-light plant in Stroh. The Stroh Cement Company is interested in the project.

CHICAGO, ILL.—Plans are being prepared by A. S. Alschuler, 20 East Jackson Boulevard, Chicago, architect, for the erection of a two and three-story power house and dry kiln on Ogden Avenue, between Keeler and Kedvale avenues, for the Turner Manufacturing Company, 1444 South Sangamon Street, to cost about $150,000.

ORION, ILL.—The local electric-light plant has been purchased by D. W. Bowen of Sherrard. Improvements will be made by the new owner, including the installation of a new engine and establishing a continuous service. It is proposed eventually to supply electricity to neighboring towns and surrounding territory.

OTTAWA, ILL.—Work has begun on the construction of a new power plant for the Northern Illinois Light & Traction Company. The equipment will include a 4000-kw. turbo-generator. An outdoor transformer station will also be erected in connection with this station.

PEORIA, ILL.—At an election to be held April 3 the proposal to issue $60,000 in bonds for the construction of an underground conduit system for electric wires will be submitted to the voters.

ELKHORN, WIS. — Contract has been placed by the Municipal Light and Water Commission for ornamental street-lighting system, consisting of 57 series street lamps of 250 and 400 cp. and one 17-kva. automatic regulator. Fritz Ohesson is superintendent.

ENDEAVOR, WIS. — Plans are being prepared by the Endeavor Light & Power Company for erecting an electric transmission line to Packwaukee, a distance of 5 miles, and also for making some changes in equipment of power house. William H. Burwell is manager.

KAUKAUNA, WIS.—The Municipal Electric and Water Department contemplates the construction of a hydroelectric plant to develop about 7000 hp. under a 26 ft. head, using vertical generators. Work on the proposed development may begin this summer. William B. Montgomery is manager.

MANITOWOC, WIS.—Plans are being prepared by the Woodmansee-Davidson Company, First National Bank Building, Chicago, Ill., for the erection of a hydroelectric power plant at Manitowoc for the Wisconsin Public Service Company, a subsidiary of the Wisconsin Securities Company of Milwaukee, to cost about $250,000.

MARSHFIELD, WIS.—Preliminary plans are being prepared for the construction of hospital building, power house and laundry, to cost about $100,000, for St. Joseph's Hospital. Emil Brielmaier & Sons Company, University Building, Milwaukee, are architects.

NEILLSVILLE, WIS. — Bids will be asked by the Water and Light Commission of Neillsville, it is reported, for an electrically operated pumping unit of 5500 gal. per minute capacity. Mead & Seastone of Madison, Wis., are consulting engineers.

SHEBOYGAN, WIS.—Plans are being prepared by the Eastern Wisconsin Electric Company of Sheboygan for the installation of a 7500-hp. turbo-generator unit at its local plant, which with other improvements contemplated, will cost about $150,000.

PRINCETON, MINN. — The Elk River (Minn.) Power Company is reported to be negotiating for the purchase of the municipal electric-light plant at Princeton.

ST. CLOUD, MINN.—The St. Cloud Public Service Company is erecting a new 16,500-volt transmission line, which will supply electrical service to the towns of Clearwater, Clear Lake, Becker, Monticello and Big Lake. Another new line will be extended to Foley. Wheelock Whitney is treasurer.

ST. PAUL, MINN.—The Chicago, St. Paul, Minneapolis & Omaha Railroad Company is contemplating the construction of a power house and addition to its shops at West Seventh Street, St. Paul, to cost about $300,000. A. W. Trenholm of St. Paul is general manager.

BONAPARTE, IOWA.—The Iowa Electric Company of Cedar Rapids has applied for a franchise to supply electrical service in Bonaparte.

CEDAR RAPIDS, IOWA.—The Iowa Railway & Light Company is planning to erect a high-tension transmission line from its power plant at Nevada to the Dayton Lake Amusement Park, 11 miles long, to furnish electricity for lamps and motors to the parks and also to the farmers along the line. Plans are also being prepared to extend the line through Gilbert to Story City.

DANBURY, IOWA.—The Board of Railroad Commissioners has granted Mark Durst and Godfrey Durst, Jr., a 25-year franchise to erect and operate electric transmission lines for the distribution of electricity upon the roads and highways in Woodbury County.

IOWA FALLS, IOWA.—The Iowa Falls Electric Company has applied to the State Railroad Commission for a franchise to erect an electric transmission line in Worth County and also in Hancock and Cerro Gordo Counties.

SHENANDOAH, IOWA.—Improvements are contemplated to the light, heat and gas plant. Burns & McDonnell, Interstate Building, Kansas City, Mo., are engineers.

SPENCER, IOWA.—Plans have been approved by the City Council for improvements to the electric-light and power plant.

WEST LIBERTY, IOWA.—The City Council has voted to abandon the municipal electric-light and power plant and secure energy from the Iowa Light & Power Company of Cedar Rapids. The company will extend its electric transmission line from Iowa City to West Liberty. The Iowa company will also furnish electrical service in West Branch.

HANNIBAL, MO.—The plant and holdings of the North Missouri Light & Power Company in Hannibal have been purchased by the Illinois Traction Company. It is understood that the transmission lines of the company would be extended on toward Mexico, Mo., in the near future.

HUME, MO.—A. G. White, owner of the local electric-light plant, contemplates the installation of a 15 or 20-kw., three-phase, 60-cycle, 2300-volt generator, driven by an oil engine. The equipment may be new or second hand.

KANSAS CITY, MO.—Plans have been outlined by the Kansas City Railways Company for improvements to its system. The chief changes are to be made in the distribution of power and will involve the abandonment of two substations this year, a third later, and the establishment of five others at various locations this year and two more later. A portable automatic substation has been ordered for delivery this summer. The only equipment to be purchased for the new substation is a 3000-kw. rotary converter; eventually three 1500-kw. rotary converters, one 2000-kw., three 1000-kw., one 800-kw., one 600-kw. and four 750-kw. converters will be installed in the new substation. Some of the equipment will come from the stations abandoned. Extensive improvements are to be made at the power plant and distributing system, involving an expenditure of about $370,000, of which $100,000 will be used for the power plant; $161,000 for substations; $30,000 for switch houses and $43,000 for overhead lines.

NEW LONDON, MO.—The property of the North Missouri Light & Power Company of New London has been purchased by the Illinois Traction Company of Peoria, Ill.

ST. JOSEPH, MO.—Plans are being considered by the St. Joseph Railway, Light, Heat & Power Company for the erection of a new power station, to be used in connection with the present power house at the foot of Felix Street. An expenditure of $50,000 for equipment to increase the boiler capacity of the present power plant has been authorized by the officials of the company.

MARVIN, S. D.—The City Council has decided to install an electric-lighting system.

FREMONT, NEB.—Plans are being prepared by the Fremont Gas, Electric Light & Power Company for extensions to its plant. New Equipment, including one 625-kva. Westinghouse turbine and one 450-hp. Stirling boiler will be installed. It is not yet decided whether an entirely new building will be erected or an addition built to the present plant. H. C. Fuers is manager.

FREMONT, NEB.—The new Gisen grain elevator of the Nye-Snyder Fowler Company of Fremont will be equipped for electrical operation. The company has contracted with the municipal plant for energy to operate the elevator. This will make it necessary to increase the output of the municipal electric plant. It is proposed to install new equipment, including turbines and transformers, increasing the generating capacity to 300 kw.

JOHNSTOWN, NEB.—A petition has been presented Council asking that an election be called to submit the proposal to issue $15,000 in bonds for the installation of an electric-light plant and water-works system.

LITCHFIELD, NEB.—Bonds to the amount of $7,000 have been voted for the installation of an electric-lighting system.

OMAHA, NEB.—Contract for the construction of power house and extension to Union Pacific Shops, to cost about $600,000, has been awarded to the Westinghouse Church Kerr Company, 37 Wall Street, New York, N. Y. Eight new boilers of 400 hp. each will be installed in the new station.

ALMA, KAN.—The Alma Light & Ice Company is contemplating the erection of an electric transmission line and discarding its electric generating plant. George D. Page is manager.

BISON, KAN.—The installation of an electric-light plant in Bison is under consideration. It is proposed to erect an electric transmission line to La Crosse to obtain electricity to operate the system.

CAPRON, KAN.—Application has been made to the town of Capron by Mr. Darling of Hardtner for a 20-year franchise to install an electric-lighting system here.

CIMARRON, KAN.—The City Council is considering the installation of a municipal electric-lighting system. Electricity will be obtained from either Dodge City or Garden City. The Midland Water, Light & Ice Company of Dodge City and the Garden City Telephone, Light & Manufacturing Company have both submitted proposals to furnish the service.

INDEPENDENCE, KAN.—At an elec-

tion to be held April 3 the proposal to issue $75,000 in bonds for the installation of a municipal electric-light plant will be submitted to the voters.

LA CYGNE, KAN.—The Pleasanton (Kan.) Electric Company has submitted a proposal to the City Council offering to erect a transmission line from Pleasanton to the city limits and to furnish electricity to the city of La Cygne at 4 cents per kw.-hour. If the city of La Cygne would build the line the company would furnish energy at 3 cents per kw.-hour. The company proposes to install a plant and supply energy to surrounding towns and villages.

Southern States

SPRING HOPE, N. C.—J. B. Privette and others, it is reported, contemplate developing the Webb Mills water power, several miles from Spring Hope, and constructing a hydroelectric plant.

CHARLESTON, S. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until April 9 for shipbuilding crane (electrically operated) under specification No. 2331, at the Navy Yard, Charleston, S. C.

CHARLESTON, S. C.—Bids will be received by Todd, Simons & Todd, architects, 63 Broad Street, Charleston, until March 29, for construction of a four-story hospital building in the city of Charleston. Bids will be received for building complete, except heating, plumbing and electric wiring, for which bids will be received separately. Plans and specifications may be obtained from the architects upon deposit of $25, of which $15 will be refunded.

SENECA, S. C.—The municipal electric-lighting system will connect up with the transmission system of the Southern Power Company of Charlotte about April 1. Charles Floyd is manager.

DAVISBORO, GA.—The City Council has engaged W. M. Crook, Grand Building, Macon, to prepare plans and estimates for the installation of a municipal electric-light plant.

THOMASVILLE, GA.—Improvements to the municipal electric-light plant are reported to be under consideration.

TAMPA, FLA.—The Tampa Electric Company is planning to double the output of the West Jackson Street power house. The work will include addition to building and installation of an additional 7200-kw. steam turbo-generator. The Stone & Webster Management Association, 147 Milk Street, Boston, Mass., has charge of the plant.

COLUMBIA, ALA.—J. Ed. Foy and Dermot Shemwell of Lexington, N. C., who have organized a company with a capital stock of $100,000 for further development of a water power on Musser Creek, near Columbia, which they have recently purchased. It is proposed to build a dam and reconstruct the plant. Contracts to supply electricity in Columbia, Ashford and Headland have been acquired. The main office of the company is at Lexington, N. C.

TYLERTOWN, MISS.—Within the next 18 months the Tylertown Electrical Company expects to build a new power station and install another generating unit for day service; also in the meantime to put the entire town on a meter service.

PINE BLUFF, ARK.—The Pine Bluff Company contemplates extending its high-extension transmission lines to Stuttgart, England and other towns and cities.

BATON ROUGE, LA.—The Yazoo & Mississippi Valley Railroad Company is contemplating equipping a mechanically operated coaling station, to cost about $20,000, at Baton Rouge.

GATE, OKLA.—Bonds to the amount of $7,000 have been voted for the installation of a municipal electric-light plant.

HEADRICK, OKLA.—The installation of an electric-lighting system in Headrick is under consideration.

McALESTER, OKLA.—The Pittsburgh County Railway Company, which operates the local street railway system is contemplating the installation of a 3500-kw. steam turbo-generator in its power station at Ninth Street and Johnson Avenue.

ABILENE, TEX.—The American Public Service Company of New York, N. Y., which operates electric plants and other public utilities in Abilene, Baird, Cisco, Jefferson, Longview and Marshall, Tex., and Hugo and Henryetta, Okla., has sold its properties to the Insull Syndicate of Chicago, Ill. The new owners, it is stated, will install new machinery and make important improvements to some of these plants.

BEAUMONT, TEX.—Preparations are being made for the installation of new equipment for the Beaumont Iron Works, to cost about $65,000. Electric generating machinery and an electric steel furnace will be included in the equipment.

HOUSTON, TEX.—The Intermountain Railway, Light & Power Company of Colorado Springs, Col., has been granted a permit to do business in the State of Texas. The headquarters of the company will be in Houston and it will operate in Navasota, Sour Lake and Silsbee.

Pacific States

CASHMERE, WASH.—An agreement has been reached between the Town Council and the Wenatchee (Wash.) Valley Gas & Electric Company, whereby the contract for furnishing electricity has been awarded to the company.

LA CROSSE, WASH.—Application has been made to the Council by Harry G. Wilson for a franchise to install and operate an electric-light and power plant in La Crosse.

SEDRO WOOLLEY, WASH.—The contract for street-lighting has been awarded to the Pacific Northwest Traction Company for a period of five years. Considerable extensions, it is understood, will be made to the local system and new lamps installed.

ARCADIA, CAL.—The Board of Trustees has decided to install an ornamental street-lighting system, to be maintained by underground wires, on First Street.

BEVERLY HILLS, CAL.—Bids will be received by Sidney C. Rowe, city clerk, Beverly Hills, until April 2 (extension of date from March 12), for installation of an ornamental lighting system, consisting of 361 marbelite or metal posts, etc.

CROCKETT, CAL.—The Great Western Power Company of San Francisco is planning to erect a large substation at Crockett. The proposed station, it is said, will be used as a central distribution plant and will cost about $250,000.

MARYSVILLE, CAL.—Plans have been completed by the Pacific Gas & Electric Company for the installation of a new street-lighting system, to cost about $2,500.

SAN FRANCISCO, CAL.—Application has been filed with the State Water Supply Commission by E. Fletcher, 920 Eighth Street, San Francisco, for 30 second feet of water from tributaries of Santa Ysabel River for power purposes. The plans provide for a hydroelectric development of about 3000 hp., and include the construction of a concrete dam, 110 ft. high and 800 ft. long and 5 miles of pipe line.

STOCKTON, CAL.—The Tidewater Southern Railway Company, it is reported, contemplates the construction of terminal facilities at Modesto and equipping its railway between Modesto and Turlock for electrical operation. Byron A. Bearce is president

LEHI, UTAH.—Application has been filed at the office of the state engineer by W. F. Gurney, J. W. Wing, Jr., and A. J. Evans of Lehi for 20 second ft. of water from the American Fork Creek and Deer Creek for power purposes. The construction of a power plant, consisting of a dam, headgates, pipe lines, one 18,000-ft. and another 6000 ft., and a 7542-ft. channel is contemplated by the petitioners. It is proposed to develop about 2000 hp., under a 1150-ft. head.

SALT LAKE CITY, UTAH.—The City Commission has granted the Utah Light & Power Company permission to establish and operate a steam heating plant in Salt Lake City.

ST. GEORGE, UTAH.—The Dixie Power Company, which took over the municipal electric plant in October, 1916, is installing a hydroelectric plant on the Santa Clara River. At present the company is not furnishing current anywhere except in St. George. The company expects to erect transmission lines to and install distributing systems in Santa Clara, Washington, Leeds, Hurricane, La Verkin and Toquerville, and furnish electricity by June 1. A. L. Woodhouse, care National Copper Bank, Salt Lake City, is president and manager.

MIAMI, ARIZ.—Preparations are under way for the installation of additional equipment at the power plant owned jointly by the International Smelting and Inspiration Companies, which will include an increase in blowing machinery which supplies the pressure air for converting operations; also extensions to the coarse ore bins.

GERALDINE, MONT.—A franchise has been granted to W. J. Bentson and J. Rose to install and operate an electric-light plant in Geraldine.

POLSON, MONT.—The Northern Idaho & Montana Power Company of Kalispell contemplates the erection of an electric transmission line from Big Fork to Polson, thence to Ravalli, via Ronan and Mission, and from Dayton to Polson.

ST. IGNATIUS, MONT.—The Northern Idaho & Montana Power Company of Sandpoint, Idaho, contemplates extending its electric transmission line and telephone line from Olsen to St. Ignatius, work to begin as soon as the weather will permit.

ROCK SPRINGS, WYO.—Work has begun by the Union Pacific Coal Company on combining its power plants at Superior and Rock Springs, Wyo., into one plant, to be located at the latter place. The cost of the work is estimated at $126,000 and will include a new General Electric 2500-kw. transformer and the erection of 22 miles of 33,000-volt transmission line. The plant at Superior will be held as a reserve plant. Improvements will be made in the mines, involving a further expenditure of $40,000, and will include the installation of new synchronous induction motors, etc. S. Peticolas of Omaha, Neb., is consulting engineer.

LOVELOCKS, NEV.—Preliminary work has been begun by the Nevada Valleys Power Company for the construction of a hydroelectric power plant on the Truckee River, a short distance below Vista, to develop about 2500 hp.

LAS CRUCES, N. M.—The Las Cruces Electric Light & Ice Company is installing a four-valve engine and an 180-kva. alternator (directly connected), two 125-hp. Brownell boilers, complete with Cochrane heaters and pumps. The company expects to establish a 24-hour service within four months. D. W. Morgan is general manager.

SILVER CITY, N. M.—The City Council has granted the Empire Zinc Company a franchise to build an electric railway in Silver City.

Canada

WINNIPEG, MAN.—T. H. Johnson has recommended the award of the contract for electric conduit and wiring for the new Parliament Buildings to the Mundy, Rowland Company of Vancouver, B. C., at $101,036.

CORNWALL, ONT.—The erection of a substation by the Cedar Rapids Transmission Company in Cornwall is under consideration. The initial installation will provide for an output of 3000 hp.

HANGINGSTONE FALLS, ONT.—Work has been started on the construction of a power plant at Hangingstone Falls for the South Bay Mines Company, under the supervision of Lynn Adsit, mining engineer. The plans provide for an ultimate development of between 1500 and 2000 hp. The first unit with an output of from 300 to 400 hp., it is expected, will be ready for operation by next September. Sutcliffe & Neelands, Haileybury, Ont., are in charge of the work.

LONDON, ONT.—Plans are being considered by the Victoria Hospital Trustees for the purchase of an auxiliary electric-lighting system.

NORTH COBALT, ONT.—The local car barn of the Nipissing Central Railway Company was recently damaged by fire. The loss to electrical equipment is placed at $30,000; to cars, $60,000, and to building, $40,000.

EAST ANGUS, QUE.—The Brompton Pulp & Paper Company is contemplating another hydroelectric development, 3 miles below their pulp and paper plant at East Angus, on the St. Francis River. Plans are being prepared to develop an additional 6000 hp.

GREENFIELD PARK, QUEBEC.—The Town Council has engaged W. G. H. Cam, consulting engineer, 3 Beaver Hall Square, Montreal, to prepare plans and specifications for the installation of an electric-lighting system and also to supervise the work.

MONTREAL, QUE.—W. L. Miller & Company, 44 George Street, Montreal, it is reported, contemplate the purchase of engines, boilers, motors, and planing-mill machinery, machine-shop and railroad equipment.

HUMBOLDT, SASK.—Improvements are contemplated to the municipal electric light plant, including the installation of an additional boiler with surface condenser and circulating pumps. F. K. Martin is manager.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until March 29, for furnishing the following supplies; 70 ft. tool steel, 500 lb. special bronze, 2000 ft. brass tubing, one motor-driven automatic screw machine and 5000 ft. 2-conductor cable, etc. For further information address the above office.

14,270. CENTRIFUGALLY-REGULATED POWER-TRANSMISSION SYSTEM; William Morrison, Chicago, Ill. App. filed Sept. 9, 1916. Improvements.

14,271. DYNAMO-ELECTRIC CLUTCH; William Morrison, Chicago, Ill. App. filed Sept. 9, 1916. Speed regulation of an automobile is effected by varying the speed of the engine, the dynamo acting in the main simply as an electromagnetic clutch, and generating only enough current, under normal running conditions, to produce the requisite clutching effect.

1,218,621. SLIP-COUPLING FOR ELECTRIC-CABLE CONDUITS; Maurice Blumenthal, Brooklyn, N. Y. App. filed Feb. 1, 1915. Electric cable conduits may be quickly and easily connected.

1,218,650. SYSTEM FOR AMPLIFYING ELECTRICAL ENERGY; Ralph V. L. Hartley, New York, N. Y. App. filed July 8, 1914. Increase the amplification of a repeater system beyond its normal capacity therefor.

1,218,682. POLICE SIGNALING SYSTEM; Louis W. Miller, Rochester, N. Y. App. filed Aug. 23, 1911. Police officers or roundsmen may be called or summoned from headquarters or a precinct station.

1,218,692. CLOCK; Charles Edouard O'Keenan, Paris, France. App. filed Oct. 20, 1913. Synchronous electrical clock.

1,218,747. MULTISPEED INDUCTION MOTOR; Rae W. Davis, West Allis, Wis. App. filed Feb. 7, 1913. Capable of efficient operation at a plurality of speeds.

1,218,768. THERMOSTATIC REGULATOR; William C. Heindl, Rochester, N. Y. App. filed March 29, 1915. In connection with heating systems, to regulate the temperature of a building.

1,218,772. BATTERY DEPOLARIZER; Major E. Holmes, Lakewood, Ohio. App. filed Dec. 13, 1913. Preparation of battery depolarizers and more particularly to manganese compounds for such use in dry cells.

1,218,795. INDICATING AND RECORDING APPARATUS; Benjamin Frederic Merritt, East Orange, N. J. App. filed June 21, 1915. Remote control type.

1,218,796. SIGNAL TRANSMITTER; Benjamin Frederic Merritt, East Orange, N. J. App. filed June 30, 1915. Automatic type.

1,218,799. PHONOGRAPH RECORDER AND REPRODUCER; Herman G. Pape, New York, N. Y. App. filed March 8, 1915. Practical means for making records on phonograph recording blanks as cylinders, disks, or the like, of mechanically or telephonically transmitted sounds such as musical productions, speeches, or other subject matter which it may be desired to record for phonographic reproductions.

1,218,802. APPARATUS FOR ELECTROPLATING PIPES, RODS, ETC.; Nelson H. Raymond, Buffalo, N. Y. App. filed Sept. 15, 1915. Means for feeding the pipes automatically step by step.

1,218,804. SELECTIVE SIGNALING SYSTEM; Frank N. Reeves, Newark, N. J. App. filed Feb. 27, 1915. Partly line selective signaling in telephone exchange systems.

1,218,805. AUTOMATIC CALL-DISTRIBUTING SYSTEM; John G. Roberts, Dobbs Ferry, N. Y. App. filed March 7, 1914. Rapid recording at the central office of subscribers' line numbers.

1,218,806. TELEPHONE TRUNKING SYSTEM; John G. Roberts, Dobbs Ferry, N. Y. App. filed Dec. 8, 1914. Applicable especially to two-wire trunks between offices.

1,218,817. APPARATUS FOR PRODUCING OZONE; Melbourne Roy Tennant, Colorado Springs, Col. App. filed July 12, 1913. Means for producing electric arcs for emitting a constant glow of light.

1,218,847. EMERGENCY POWER DEVICE; William Payson Firey, Roanoke, Vt. App. filed June 22, 1915. Improvements.

1,218,850. TREATMENT OF SEEDS; Henry Ernest Fry, Godmanstone, Dorchester, England. App. filed June 3, 1916. To render them more productive.

1,218,864. SIGNAL; William Robert Honeyball, Pasadena, Cal. App. filed July 25, 1916. Adapted for use on self-propelled vehicles.

1,218,870. DUPLEXING TELEGRAPHIC LINES; Isidor Kitsee, Philadelphia, Pa. App. filed Dec. 30, 1916. Produce efficient means to duplex telegraph lines.

1,218,890. ELECTRIC SWITCH; Clarence D. Platt, Bridgeport, Conn. App. filed April 20, 1916. Reduce the shock of the switch movements.

1,218,892. MUFFLER FOR TELEPHONES; Aleksander Pludowski, Waterbury, Conn. App. filed Aug. 3, 1916. Improvement.

Record of Electrical Patents

Notes on United States Patents issued on March 11, 1917

1,218,916. METHOD AND APPARATUS FOR SEPARATING MAGNETIC ORES; Joseph Weatherby, New Cumberland, Pa. App. filed June 12, 1915. Improvements in the treatment of magnetic ores in a subdivided mixture consisting of particles having different degrees of magnetic permeability.

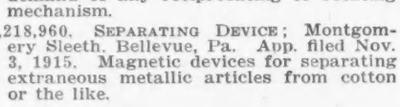
1,218,934. SOUND EMITTER; Sydney Evershed and Willie Dickson Kilroy, Chiswick, England. App. filed May 3, 1910. Electric vibratory motors and their application for signaling to a distance.

1,218,935. LOW-WATER ALARM; Charles R. Ford, Paducah, Ky. App. filed Aug. 26, 1915. For use upon steamboats and other water-navigating vessels.

1,218,952. RECTIFIER FOR POLYPHASE ALTERNATING CURRENTS; Ernst Oelschlager, Berlin-Charlottenburg, Germany. App. filed Nov. 20, 1913. Employing liquid mercury.

1,218,955. SERVICE DEMAND OR OPERATION RECORDER; Emmet Grattan Ralston, Indianapolis, Ind. App. filed April 8, 1916. Provision of an instrument which may be used in connection with any source of electrical energy for the permanent recording of service, operation or periodic demand of any reciprocating or rotating mechanism.

1,218,960. SEPARATING DEVICE; Montgomery Sleeth, Bellevue, Pa. App. filed Nov. 3, 1915. Magnetic devices for separating extraneous metallic articles from cotton or the like.



1,218,621—Slip Coupling for Electric Cable Conduits

1,218,967. SEPARATOR FOR STORAGE BATTERIES AND PROCESS FOR MAKING THE SAME; Theodore A. Willard, Cleveland, Ohio. App. filed July 24, 1914. Separator having contained or embedded in the body thereof a layer or sheet of material which produces the pores and which is exposed at intervals on opposite sides of the body.

1,218,998. SYSTEM FOR PACKING AND SHIPPING TELEPHONE APPARATUS; Alexander M. Haubrich, Chicago, Ill. App. filed May 23, 1913. Improvement.

1,219,001. GOVERNOR AND AUTOMATIC CUT-OUT FOR ELECTRIC GENERATORS; Solomon F. Johnson and Levi P. Ayres, Indianapolis, Ind. App. filed Dec. 15, 1913. Apparatus adapted to establish a circuit between a battery and generator after the latter has developed the required voltage for charging the battery and disconnecting the generator from its driver when the generator has reached a predetermined speed so as to prevent the overcharging of the battery.

1,219,002. ELECTRIC SWITCH; Solomon F. Johnson and Levi P. Ayres, Indianapolis, Ind. App. filed July 27, 1914. Improvements.

1,219,003. BINDING POST; William Kaisling, Chicago, Ill. App. filed Aug. 4, 1913. Spring binding post.

1,219,008. SYSTEM FOR SUPPLYING ELECTRICITY; William Oscar Kennington, Anderson, Ind. App. filed May 21, 1914. Employment of a relay having a magnet responsive to the output of the source.

1,219,063. ELECTRICAL PIANO; Mario Arese, Turin, Italy. App. filed May 3, 1916. Modifying the intensity of the sound along the keyboard.

1,219,074. GALVANIC BATTERY CELL OF THE MERCURIC-OXID TYPE; Johannes Nicolaus Bronsted, Copenhagen, Denmark. App. filed Aug. 4, 1915. Improvements.

1,219,098. TROLLEY EAR; William F. Hall, Newton, Mass. App. filed Oct. 15, 1915. Trolley wheel may freely pass over it without arcing.

1,219,109. POCKET FLASHLIGHT; Morduch L. Kaplan, Brooklyn, N. Y. App. filed Jan. 16, 1915. Vest pocket.

1,219,110. METHOD OF AND MEANS FOR QUADRUPLEXING CABLES; Isidor Kitsee, Philadelphia, Pa. App. filed Dec. 30, 1916. Improvements.

1,219,132. METER-TESTING CUT-OUT; Thos. E. Murray, New York, N. Y. App. filed Dec. 5, 1912. Testing devices may be applied to meter case.

1,219,134. SWITCH; Thomas E. Murray, Jr., Brooklyn, N. Y. App. filed June 3, 1916. Fuse is carried on the switch lever and the co-operating contacts are simplified.

1,219,135. METHOD OF FLANGING THE END OF A METAL TUBE; Thomas E. Murray, New York, N. Y. App. filed Nov. 29, 1916. Improvement.

1,219,136. ELECTRICAL WELDING APPARATUS; Thomas E. Murray, New York, N. Y. App. filed Nov. 29, 1916. From a welded joint between the butt end of a tube, or pipe, and a circular shoulder on the inner periphery of a sleeve receiving said tube.

1,219,137. ELECTRICAL WELDING APPARATUS; Thomas E. Murray, New York, N. Y. App. filed Nov. 29, 1916. Rotation of one of the two bodies to be welded causes a movement of the other of said bodies into pressing contact with said rotating body at the welding joint.

1,219,138. ELECTRICALLY-WELDED TUBE AND FLANGE; Thomas E. Murray, New York, N. Y. App. filed Nov. 29, 1916. Improvement.

1,219,139. METHOD OF ELECTRICALLY WELDING THE END OF A TUBE WITHIN A SLEEVE OR SOCKET; Thomas E. Murray, New York, N. Y. App. filed Dec. 14, 1916. Improvement.

1,219,143. SUPERVISORY SYSTEM; James G. Nolen, New York, N. Y. App. filed July 23, 1909. Employed for indicating sudden and excessive rise in temperature.

1,219,171. CHANDELIER; Moritz D. Schwartz, New York, N. Y. App. filed Oct. 2, 1916. Indirect lighting systems.

1,219,189. AUTOMATIC RECORDING FIRE ALARM; Henry Symes, Mornington, near Dunedin, New Zealand. App. filed Oct. 8, 1913. Improvements.

1,219,194. ELECTRIC ZINC-DISTILLING FURNACE; John Thomson, New York, and Francis A. J. Fitz Gerald, Niagara Falls, N. Y. App. filed June 21, 1916. Minimize the cost of transforming metal into fume or gaseous vapor, to retain certain elements of the fume within the furnace and to then evacuate and conduct other portions of the fume.

1,219,215. SYSTEM OF SPACE SIGNALING; James C. Armor, Brooklyn, N. Y. App. filed July 26, 1912. Provide adequate electrical means whereby the normal inductance of the inductive means referred to may be maintained at approximately a predetermined value.

1,219,216. SYSTEM OF SPACE SIGNALING; James C. Armor, Ingram, Pa. App. filed Oct. 14, 1913. Transmitting station of a system of wireless telephony.

1,219,228. ELECTRICAL GROUNDING CLAMP; James Elbert Birdsall, Philadelphia, Pa. App. filed Aug. 17, 1915. All tendency to loosening or shifting may be obviated.

1,219,230. ELECTRIC ROUTE INDICATING AND LIGHTING SYSTEM; Alfred Blackmore, Kensington, London, England. App. filed Oct. 7, 1916. Adapted to be controlled by means of switches.

1,219,245. SPEEDOMETER; Allen A. Canton, New York, N. Y. App. filed Aug. 8, 1916. Electrically operated.

1,219,250. LOCK-CASE REVERSING MECHANISM; Robert Cecchini, West Springfield, Mass. App. filed July 12, 1915. A combination lock for a safe.

1,219,264. GAGE; Horace L. Dawson Evanston, Ill. App. filed Nov. 21, 1908. Level of a liquid in a tank.

1,219,265. ELECTRIC FLUID HEATER; Harry W. Denhard, San Francisco, Cal. App. filed Dec. 20, 1915. Regulator which will render the heater adapted to heat liquids of different specific resistance to any desired temperature.

1,219,300. SPARK COIL; John Alden Hall, East Orange, N. J. App. filed Aug. 25, 1915. Casing for an induction coil and condenser which are self-contained and substantially inclosed within said casing.

1,219,333. WATER-PURIFYING APPARATUS; John D. Kynaston, Washington, D. C. App. filed Nov. 15, 1916. To convert nitrogenous and other soluble impurities and animal and vegetable matters either in solution or suspension into insoluble precipitates to produce a coagulum for mechanical separation as by settlement.